A critical approach to business process modelling in small to medium sized enterprizes

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Abstract

The research issue for this thesis was founded within the RAMESES project, but is specifically concerned with the necessity for SMEs to undertake the activity of business process modelling. The need to understand the 'as is' position of an organisation is fundamental to the development, change or implementation of any information or communication technologies (ICT). The primary research question was 'are SMEs able to model business processes in such a way that will enable the effective analysis of the organisation in order to enable information systems development change or implementation'.

The objective of the research was to develop a method by which this business process modelling activity could be supported in a fashion which was accessible and effective within the target environment. This thesis expounds the benefits of using a critical approach utilizing a combination of qualitative and quantitative research methods within the bounds of a multi-disciplinary research team to enable effective exploration and investigation. The concept of the research life-cycle has developed the notion of appropriateness in method and approach: this is discussed against the values of the critical and realist paradigms.

The issues reported in this thesis have been identified as a result of detailed case study analysis of six small organisations in the North-east of England.

The conclusions are presented in three sections firstly the conclusions relating to the SME and the appropriateness of the BAM technique developed within the RAMESES project. Secondly conclusions are given in regard to the research methodology and reflections given as to the efficacy of the process. Thirdly reflections and conclusions are presented that relate to the work in relation to its overall critical aims and finally makes suggestions as to how future work could be improved.

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CHAPTER 1

The research issue

Introduction

The relationships between people, organisations and IT (information technology) present a complex range of factors to be disentangled. The approach by which this complexity is conceptualised can offer a mechanism to aid the defining of the problem and formulating a solution. The concept of the "wicked problem" (Churchman, 1967) has been particularly helpful and is further described below. It provides a mechanism by which the relationship between people, organisations and IT can be unravelled. The concept of the "wicked problem" does not lead the researcher to attempt to reduce the problem to isolated variables, and a series of steps to be followed sequentially. Instead, it advocates a pragmatic oscillation between problem and solution, so that the understanding of each of them evolves concurrently.

The project in which this conceptualisation was tested was the RAMESES project. The overall objective of this project was "to provide a strategic model for the risk assessment of legacy software systems within SMEs (Small-to-Medium Enterprises) considering business process change." Thus the relationship between the organisation, the way its staff carried out its processes and their legacy IT systems was the centre of concern.

The author of this thesis was the senior research fellow throughout the project, responsible for in the first instance the data gathering process, (see appendix 4 for supporting evidence) and in the second instance for the development of the Business Activity Modelling technique (BAM, further described in detail in chapter 6). This technique was critical to the success of the project as the business audit process (described in chapters 5 and 6) was the key to the level of organisational understanding required to assess the risk of change.

In order to allow the problem definition and solution to evolve together, grounded theory (Strauss & Corbin, 1997) was chosen as the initial methodology and populated with a method which helped us to focus on both the problem area and solutions at the same time. This thesis describes how the broad conceptualisation of the problem led to a detailed method to address it and the results available.

The research issue

The term wicked problem was initially used by Rittel and Webber (1984) in a design context. Budgen in 1993 picked out the four characteristics he identified as most relevant to the process of software design. These also seem those most relevant to the more general study of information systems in organisations and are as follows:

There is no definitive formulation of a wicked problem. A wicked problem cannot be reduced to a series of steps that need to be followed in order to reach a solution. Any series of steps so designed will address only part of the problem. By following a series of steps one may not even arrive at a partial solution, the process may actually make the problem worse.

Wicked problems have no stopping rule. Wicked problems are dynamic. One may derive a solution, which appears to solve the problem at one point in time, but that solution will in itself affect the problem. People will react to the solution that they are given and the problem will evolve in new and unexpected ways. Often, the scenario, which is nominally designated as the solution, is only acknowledged as such because time and/or money have run out on the problem. Concepts such as "structuration theory" (Giddens, 1984) are informative when involved with wicked problems. They acknowledge that the way in which people interact with the structures within which they operate acts upon the structures themselves to change them.

Solutions to wicked problems are not true or false, but good or bad. Because the way to tackle the problem is not reducible to a series of steps the solution will never be a neat fit. The notion of a *good* or *bad* solution has a subjective tenor to it. That is because it **is** subjective. A solution may only be evaluated in the light of what one wished to achieve, not in any absolute sense.

Every wicked problem can be considered to be a symptom of another problem. Because of the interconnectedness of things, one's investigation into a wicked problem might reveal deeper underlying causes, or simply other factors at the same level, which are embedded in different issues. What is a "good solution" to the problem must be judged entirely on the basis of what the researcher was expected and empowered to achieve, not on the basis of completeness or finality.

'Solving' wicked problems

Both Conklin & Weil (1998) and Budgen (1993) refer to the waterfall model of software design (Royce, 1970) as having some elements which are useful in the solution of wicked problems and some elements which are not. The fact that the waterfall model implies a simple progression from one stage to the next in the process of designing software is unrealistic in the case of wicked problems. It is unlikely that a wicked problem could be grasped or understood from the start in order to allow a simple progression to the design of a solution. Concessions to the complexity of real life (and to what Budgen (1993) calls "the wickedness of problems") are the multiple feedback loops that move back up the waterfall. They introduce the notion of going back and reformulating the problem.

Conklin & Weil, (1998) describes the behaviour of designers in the MCC Elevator study. Their study showed that designers did not, in fact work in a linear progression from analysis of the problem to formulation of a solution. These processes were not two sequential stages, but were different activities between which the designer oscillated. Analysis was carried out in order to assess the feasibility of possible solutions. The solutions that were available to some extent guided the analysis that was possible.

In terms of the traditional waterfall model, this manner of oscillating between analysis and design might be considered at best pragmatic, and at worst disorganised. However, in light of the characteristics of wicked problems (described above), this may be considered a sensible approach. Therefore, a method that insisted that analysis be complete before work may start on the design of a solution could be doomed in the arena of wicked problems. Such a problem needs to be scoped in terms of the time and budget allowed for its solution, the kind of solution expected, and the subject or area which is to be addressed by the solution (e.g. communication, over-competitive behaviour, or competition culture). Therefore, the problem space will be determined by the solution space. In the words of Conklin & Weil (1998)
"You don't understand the problem until you have developed a solution."

Why organisations are wicked

Organisations are "wicked" in a number of different ways. Positivist science tends to look at an area of study, identify variables, isolate them and study each in isolation, and then model the way in which these act together. In this way, hypotheses are accumulated and are articulated as a theory. In the study of organisations, it is possible to identify the variables that bear upon a particular situation, and often to have some feel for their relative importance, but to isolate them is to diminish their meaning. To decontextualise a process or an operator in order to study them, is to take away their meaning or *raison d'être*. Within the scientific framework, an experiment should be "controlled": i.e. all extraneous factors should be removed, in order to better observe the working of the variable under study. By contrast, many interpretivists believe that there is no such thing as an extraneous factor. If you try to remove some of the factors that operate on a situation, then you are removing context and meaning. It may be seen then that any problem with a social element will ramify greatly (Shurville et al., 1997) thus making it wicked. Just as the interconnection of variables is endless, so are the implications of any change or posited solution.

If you isolate a variable, you remove it from its context. For instance, during the RAMESES project (see section 3), the researcher studied the relationship between an organisation's legacy systems and its business processes to see whether the fit was good or whether there were areas of risk. It is possible to isolate this relationship in the following way. One could model the way in which the process works according to the appropriate manager, and then using the same technique, show the way in which the software related to that business process works, and then compare the two mappings. This would allow an analysis of fit or lack of it, however many important factors have been excluded. Both managers and the staff who operate the computer system may have different expectations of it from those that it was designed to deliver. A study of the business process and the computer system as they operate could reveal a different pattern from the ideal ones modelled above. Such a study will reveal short cuts, extra activities, and clever solutions to problems, even abuses. Both the way in which the business process is carried out, and the way in which the computer system is being used could be affected by company culture, by the degree of unionisation and demarcation, by the education and flexibility of the staff, and by whether the company is buoyant and profitable or defensive and unprofitable. The geographical locus on a site or between sites may have an effect. The wider context of the organisation may have a huge influence: for instance where a particular computer system may have a role in the supply chain. A particularly important supplier or customer may have dictated its use with no reference to the organisation's business processes. Above all, the **history** of both the computer system and also the business process may also have an effect: e.g. resentments may still endure following poor practice in technology transfer or in change management.

Beyond this lies a mirroring layer of complexity. This is the layer of the researchers' own attitudes, shaped by their background, their history of experiences and their personality. In some ways this is not open to study by the researcher since they are inside the situation and cannot see the whole of it. Positivist scientists favour objectivity - the putting aside of the researcher's own views and values in order to establish objective truths. Interpretive social scientists feel this is impossible (Winch 1958), as being inside the situation, the researcher cannot even identify all those factors that need to be filtered out. In fact, the most fundamental and influential factors may be those, which the researcher is least able to see because they are so much a part of them. Interpretive social scientists recommend instead reflexivity. They acknowledge that a researcher's findings will be influenced by their own values and outlook, and instead promote the idea that the researcher should explore and acknowledge them. The self-knowledge will still be imperfect because the researcher is too close to the subject, but at least contemplation is encouraged with the notion of reflexivity.

What has been portrayed so far is a very indeterminate situation. It bears little resemblance to the neat isolation of variables and the extraction of objective truths favoured by positivist natural scientists. However, there are two important anchors in this complexity. One is that there is always some information about an organisation which is empirical: this is often the kind of information which is present on the annual report about number of employees, annual turnover and profit, and also demographic information about the qualifications, age and sex of staff. This kind of information is a good basis for benchmarking and comparison amongst companies. The other anchor is the kind of information that one needs to know about the company; i.e. what is the researcher's intention in studying the company. If the researcher knows what kind of problem they are interested in, or alternatively, what kind of solution they can offer then they are better able to see which variables are in the foreground and which fall into the background behind them. In this, as in the other features, organisations present situations that conform to the definition of a wicked problem.

The research issue

The research issue for this thesis was founded within the RAMESES project, but is specifically concerned with the necessity for SMEs to undertake the activity of business process modelling. The need to understand the 'as is' position of an organisation is fundamental to the development, change or implementation of any information or communication technologies (ICT). The primary research question was 'are SMEs able to model business processes in such a way that will enable the effective analysis of the organisation in order to enable information systems development change or implementation'. The objective of the research was to develop a method by which this business process modelling activity could be supported in a fashion which was accessible and effective within the target environment.

The research arena

The issues reported in this thesis have been identified as a result of detailed case study analysis of six small organisations in the North-east of England. The core business activity of the companies revolves around manufacturing and/or distribution. Although their software systems are important as a support mechanism, the primary business focus is not in software, its development or maintenance. These organisations were studied as part of the, RAMESES (Risk Assessment Model: Evaluation Strategy for Existing Systems) project. In the RAMESES project the factors that affect the fit between business processes and legacy systems were defined and categorised. These factors were then used to populate a risk assessment method to aid small businesses in understanding the range of risks facing them when they consider change (of business process or IT) typically in the context of their component-based systems. The project has adopted a wide definition of legacy systems in that legacy systems are considered to be "existing systems components that will impact upon potential changes". To this end the boundary of study may include hardware, software, communications systems and in terms of the people involved issues relating to skill levels and training.

- To study this area of risk is indeed a wicked problem. The ramifications of change in a business process are far wider than just the relationship with legacy software systems, and vice versa. The change itself may be a symptom of a threatening economic climate, or of a trend for needlessly scrapping old software systems. Change in a legacy system or in a business process may have ramifications in some of the following social and technical areas:
- employee satisfaction
- staff training
- degree of integration of the computer based systems
- degree of integration of legacy systems in business processes
- personnel profiles
- technology transfer issues
- skills base of the technical staff
- configuration management procedures
- standards operated
- quality systems used

- service issues
- communication between technical and end-user personnel
- data independence
- labour relations

Therefore, to fully analyse the effects of any change before undertaking it is not possible. However, in recognising that the research was undertaken within a wicked domain, appropriate strategies for investigation were able to be devised.

The research approach and activity

The focus of the RAMESES project, (and indeed of the EPSRC's software engineering for business process change program that funded it) is the relationship between legacy systems and business process change. Thus, our solution is given a precise context. The derivation of the solution is circumscribed both in terms of time and of money (two researchers for a total of three years - part one and part two). The form of solution promised by the project is a tool, which allows a manager or consultant within an SME to assess the risk involved in changing either a business process or a legacy IT system. To enable the development of such a tool it is essential to have an accurate picture of the organisational situation. All those factors which may be drawn into this wicked problem (and are listed in the subsection above) are thus of importance only in so far as they influence the relationship between business process change and legacy software systems and have no importance in their own right. To contextualise the issues both a foreground and background have been sketched in. Furthermore the other factors in this wicked problem are given a role by the way in which the author has chosen to conceptualise the relationship between business process change and legacy systems: which is in terms of **risk**. A broad gap or disharmony in the relationship between a business process and its supporting legacy software systems is seen to represent a large risk, and therefore an opportunity for change.

This complex shifting environment has been identified as a wicked problem. The investigation of wicked problems calls for techniques and methods beyond the scope of the positivist scientific tradition. To this end the RAMESES project has called upon the social sciences for support in developing a framework more suited to the multi-dimensionality of organisational understanding. Interpretive methods have been employed to substantiate the empirical findings of the case studies, whilst this is not new within the realms of systems research the application of critical theories, and an acknowledgement of the contribution of both quantitative and qualitative methods, has improved the viability of the method which has been developed. The breakdown of the organisational arena into a number of determinate and indeterminate viewpoints offers an appropriate means of summary. This level of abstraction allows the complexity to be deconstructed in order that a grasp may be gained on the boundaries of the problem domain.

The researcher

This thesis acknowledges that the role of the analyst and the represented inquiry is determined by the inquirer's interests and background beliefs, as well as by the questions asked. This kind of understanding of both practice and theory could provide a more robust place for analyst's activities, within information systems development and research. It is therefore imperative to the interpretation of the material presented that the biography of the researcher is incorporated into the enquiry process. The reader when presented with such a history is enabled in the understanding and subsequently the critical evaluation of the text (Tietze 1998). Such a position requires the abandonment of the 'objective' stance required by researchers in the environment of natural science, within the critical framework, the subjective nature of the researcher within the process is acknowledged and embraced as being a determinant factor in the observations reached. In order to make explicit the relationship between the research and the researcher a short biography is outlined below.

My personal history has impacted on my research beliefs from a variety of perspectives, my childhood and schooling, my early working history, my subsequent entry into higher education, and my desire to research the questions that were resultant from the combination of the previous experiences.

My father described himself politically as a communist, if it was practical, and a socialist as it was not, religiously as a Buddhist, steeped in notions of self control and personal discipline and in his work he was an engineer, manufacturing hydraulic air hose. Family evenings (without television) invariable caught us recounting incidents of the days events. War stories of the supremacy of the accountant to the detriment of production, union battles of workers situations and Eastern stories of effort and non-competition told side by side with friendship squabbles, family disputes and the sharing of household tasks were commonplace over the dinner table. I was taught chess and card games to develop strategic skills encouraged to study, although 'girls did not require degrees' and the family attitude towards graduates was coloured by the practical experience of young managers thinking that "making Wellingtons was akin to the production of air hose".

School was a varied experience where academic success was contradicted by a rebellious nature and determination to challenge the system. Avoiding sixth form I studied business studies and 'A' levels having failed to engage with the secretarial course I started. I emerged with enough qualifications to enter higher education, and began working at eighteen.

Working was an eye opening experience as the practical tasks of work clarified academic concepts that had remained elusive whilst I studied them, I worked for a stockbroker as a sales ledger clerk and observed the implementation of the first computer system and was curious about its impact. Working was a revelation of practices and procedures that were held together by 'what people knew' from a variety of jobs including credit control, purchase ledger keeping, buying, the management of sales and marketing for a couple of software houses. The key piece of information I always sought was 'who knew about that' which stemmed from my earliest working experience as an office temp. The systems I encountered were many and varied, from simple early accountancy packages to complex centralised stock control systems which supported or hindered the businesses in question. I also worked as a computing teacher in further education supporting women returnees in their desire to re-enter an increasingly complex job market. The software houses I worked in developed accountancy packages to support small organisations and one of my tasks was to configure the software and implement training appropriate to individual business needs.

Divorce led me back to education with the knowledge that only a degree would enable me to support my family unaided. I studied sociology, with a focus on social theory underpinned with no desire to be a 'social worker'. My work history converged with my studies in my final year dissertation written on the social construction of technophobia, fuelled by the years I spent with the women returnees and the small companies struggling to make sense of the systems that were purported to 'solve their business nightmares'. During this period I identified the rise of languages of specialisation, where computing terminology was responsible for the confusion and fear felt by the non-initiated. During a part-time job organising a conference and delivering training on computer maintenance I was asked to join a project involving training for engineers on a software support tool for a collaborative writing project. That research experience gave me the incentive to develop further an academic career and provided the groundwork to the approach adopted in my research for this thesis and in support of the RAMESES project.

The research contribution

This thesis offers a contribution to knowledge three key areas:

- Curran and Blackburn (2001) argue that a requirement exists for research within the field of SMEs that contributes both to both the practical body of knowledge that surrounds the SME and that this research in addition should propose theory and method in support of such findings. The research has practically raised awareness of the relationship between SMEs and the IT systems which support their organisations and offers a method by which their internal understanding of such a relationship may be improved.
- Waring, Bryans and Mavin (2003) have identified the strong position of positivist research in the management field, this thesis may contribute to knowledge in the exploration of the dichotomy which exists between the interpretivist and logical empiricist paradigms which have both contributed to the research project.
- SMEs are a domain which have been identified by Pye (2002) as has having difficulty specifying their needs in terms of training. The RAMESES method can offer a route to improvement in this area in that where SMEs better understand their current state in terms of skills and systems they are better able to articulate their specific needs.

Concluding remarks

Chapter 1 outlines the research domain, considering the concept of the wicked problem and the need for appropriate methods, techniques and approaches to the study in question. It outlines the history of the researcher and the contribution that makes to the reflexive process. The *contribution to research is made explicit in this section. This chapter concludes with outlines of the chapter and the research findings.*

The literature review is set out in chapter 2 with sections on the key components that have contributed to the study. These being the field of information systems, critical, theory, socio-technical systems SME research and approaches to business process modelling.

Chapter 3 considers the socio-technical framework under which the research is situated and its relevance to the domain of the small to medium sized enterprise. It also outlines the context of the organisations under study and offers a tablature of issues related to the research.

Chapter 4 describes the research design and methods adopted within the study. In designing the study care had to be taken to ensure the relevance of the research techniques to be used. This paper outlines the benefits of using a combination of qualitative and quantitative research methods within the bounds of a multi-disciplinary research team to enable effective exploration and investigation. The concept of the research life-cycle has developed the notion of appropriateness in method and approach: this is discussed against the values of the critical and realist paradigms.

Chapter 5 sets out the stages of the research process, in section one the context of the case study organisations is summarised. In section three the detail of the initial exploratory process is described through the data gathered in companies A and B. The RAMESES method was developed as a result of this investigation and is explained in section four. Section five demonstrates the application of the method to company C and supports the findings with illustrations from the interview process. The final stage of this process considers revision to the method following appraisal and evaluation in case studies D and E.

In chapter 6 the business process modelling technique described in the previous chapters, which has been designed for use by the general managers of small-medium enterprises (SMEs), is tested in a real world situation. A major factor in the development of the technique was the need to ensure that it was both "functional and usable": that is, it both fulfils the need to capture the business processes within an organisation and is accessible to staff who are not IT specialists and have not, necessarily, been exposed to other techniques of process modelling. The technique is more than a simple flow chart since it captures data that informs an organisation about its business processes and also allows layers of additional detail to be added in such a way that the impact of IT systems, staff competencies, resources etc can be evaluated. The case study results presented give a flavour of the "layers" and their potential usage.

Chapter 7 reviews the thesis as presented in order to present the conclusions of the research and to outline the direction of future work. The conclusions are presented in three sections firstly the conclusions relating to the SME and the appropriateness of the BAM technique developed within the RAMESES project. Secondly conclusions are given in regard to the research methodology and reflections given as to the efficacy of the process. Thirdly reflections and conclusions are presented that relate to the work in relation to its overall critical aims and finally makes suggestions as to how future work could be directed..

CHAPTER 2

Literary background to the research

Introduction

This chapter reviews literature which supports the thesis in identifying the boundary of the research undertaken within scholarly debate. The disciplinary aspects are discussed in the first section from the perspective of contextualising the work. This context is primarily that of information systems within SMEs from a critical perspective. The second section relates to the specific actions of the research which include the concept of business process modelling and related issues such as business process re-engineering. This work has been undertaken within SMEs in relation to their information technologies and within a framework which develops the concept of organisational learning. The section concludes with a summary of the literature reviewed and its concise relationship to the thesis.

Behind information systems

The importance and relevance of focusing on differences between business models and organisational practices are common to all enterprises because of the intensity and complexity of organisational behaviour in today's society. Many contemporary organisations rely heavily upon information and communications technology to sustain their business. An information system project is a complex organisational endeavour and many projects suffer from substantive difficulties in implementation (e.g. Anon, 2000). These problem scenarios could be attributed to a lack of support for the analysis of organisational aspects. Business and information system analysis, design and implementation practice could benefit from the awareness, adoption and acknowledgement of some of the more advanced theoretical (and empirical) research in the field. Experiences from information system-development practices support the suggestions that there is a serious understatement of some of the important issues which for several years have been partly discussed under labels like 'Soft Systems Methodology' (see Checkland, 1981) and more recently 'Social Informatics' (e.g. Kling, 1999).

The review begins with a brief discussion of issues within information system analysis and process representation as it has been developed and described by theorists and practitioners. It is then argued that both theory and practice seem to be informed and structured by pre-assumptions of reality, rather then as a result of an interpretative inquiry into contextual dependencies by reason of appropriately applied questions and interpretations of their answers. This work was developed in collaboration with Peter Bednar see Bednar, & Mallalieu, (2001), Mallalieu & Bednar (2003).

Backgrounds of enquiry

In the seventies, conventional systems analysis would perhaps start with a feasibility study and mainly focus on an existing or possibly manual system. The next step would be a systems investigation, intended to be a more in-depth and overall study of the existing system. The third step, labelled 'systems analysis' focused on those particular problems which had already been 'discovered' and described (e.g. Avison & Fitzgerald, 1988). However conventional systems analysis was unsatisfactory in many ways (Avison & Fitzgerald, 1988) and was followed by a number of structured approaches, more or less related to formal methods (see for example DeMarco, 1978; Jackson, 1983). Since structured methods were focused on the programmers needs (Avison & Fitzgerald, 1988), they were incapable of supporting a closer understanding of organisational issues, what was implied by the term 'analysis' in this situation remained unclear. Research efforts to redress this dilemma at least in part, tried to counteract the lack of focus on the needs of the organisational members and can be seen in such approaches as Multiview (Wood-Harper et al, 1985), ETHICS (Mumford, 1984) and Soft Systems Methodology (Checkland, 1981). By the eighties, surveys had identified a trend towards the avoidance of pre-set boundaries within the information system research community in relation to what constitutes information system research (e.g. Nissen, 1986). There are several, interpretative, traditions in information system research which may challenge the idea of an information system as a system definable within a formal and closed problem space.

As early as the 1960's Mumford and others connected information system development and its implementation to organisational change (Mumford, 1984). Mumford suggested that organisational change was inevitable if an information system was implemented in a business. Some computer scientists also recognised that information system development should be aligned with the specific business process (e.g. Langefors, 1966). It could however be argued that the business processes recognised by computer science were not necessarily well related to business strategy and business processes in general. When a fit between information system and business process integration is studied, it might be assumed that differences according to companies' specific contexts might be found. Issues in this area were recognised and studied as early as the sixties and seventies. One such example is the inquiry into the interdependence between business logistics and information systems development. The inquiry and questioning of the systems analyst is however not as clear-cut or unproblematic as some previous research might have assumed (Langefors, 1995). An analyst's inquiry into organisational processes, business logic and organisational sense-making might be much broader and deeper then any formalised inquiries into business logistics would be.

The basic business logic of different companies is not necessarily equal just because they are classified as being in the same business - what ever 'same' might mean. It is also unclear as to how idealised classifications of business processes are related to individual business processes and why such presuppositions should be seen as valid. If the assumptions of individual business classification of 'business process' are made through extrapolations from ideal descriptions (in the Weberian sense) of assumed general business models, such a connection would certainly be in need of some kind of further justification. If the assumptions regarding a classification of different organisational representations of processes are not made in this way - what are they based upon?

There are several main processes which are interrelated and therefore of interest. The business process, the business change process, the information technology development process, the information systems process and so on. We also have the process of inquiry - or the (system) analysis process. What is the significance of "Representing the process"? The process we are discussing is a representation of the analyst's inquiry into: a) the business process and b) the information system process.

Theoretical evaluation of implication characteristics

Information system research is targeting an empirical inquiry aimed at an understanding of those phenomena confronted by information system analysts and developers. The field, intertwined as it is with computer science in general, is influenced by the work of Norbert Wiener (e.g. 1948; 1950) on cybernetics, the conceptualisation of 'systems' during the 1940's and 50's by Ludwig von Bertalanffy (e.g. 1968). Development in systems thinking (e.g. Churchman, 1979) has continued to influence information system research more or less directly (see for example Avison & Fitzgerald, 1988; Checkland & Holwell, 1998) and also indirectly through issues surrounding organisational learning (on organisational learning see Argyris & Schon, 1978; 1986) among others. The scope of contemporary information system research and analysis is broad, including the effectiveness of interventions as well as theorising about phenomena like information systems, organisational analysis, or knowledge management and organisational learning (e.g. Sauer 1993). This diverse range of inquiry has motivated empirical studies based on both quantitative and qualitative methodologies. Sometimes it seems to be assumed that quantitative methodologies, drawn from the physical and social sciences, have yielded an understanding of causal relationships and the effectiveness of interventions. It has also been suggested that these methods be used to confirm theories that have measurable variables and predictive power. C. Wright Mills (1959) proposed 'abstracted empiricism' as a term to attack the atheoretical nature of quantitative social survey research.

Qualitative research in information systems was inspired by phenomenology and interpretative research in the social sciences especially founded in the symbolic interactionists of the Chicago School. Blumer (1968) was derisive of how attempts to draw correlation between variables required that little attention was paid as to how the variables were defined by those under study. The neglect of common-sense reasoning of both researchers and participants, by the choice of a purely mathematical logic for investigation was identified by Cicourel (1964). This, he stated, used ad hoc procedures to define, count and analyse variables where improvements could have been gleaned by attending to the social construction of the variables under study. In information systems research the point of using qualitative methods has been expressed as a wish to interpret the analyst's and developer's experience and understanding of a socio-technological context. Case study research that does not seek to explicitly control or manipulate variables and that it is set to study the phenomenon in its natural context has been stated by Cavaye (1996) as being the opening of an agenda for information system research.

Information system methodologists began to suggest that qualitative and quantitative methods might be productively combined. They argued that a combination of methods would create more comprehensive and complete theories of ICT related phenomena. Also it was suggested that, quantitative and qualitative methods might together create a more accurate view than any single method could produce. John Hassard (1993) suggests that a combination of paradigmatic approaches can reveal different but equally important aspects of organisational life. The assumption was that different methods mutually support and validate each other permitting a kind of 'triangulation' of the phenomenon (e.g. King, 1996).

In their thoughts about methodological triangulation, practitioners and theorists have articulated an issue that is interesting to reflect upon and to re-evaluate within the field of computer science. However, the question is not only 'How can qualitative and quantitative methodologies be integrated into a single study?' since both qualitative and quantitative can founded in a positivist perspective (e.g. Marsh, 1982). On occasion triangulation in analysis is suggested by the application of disparate methods. In such an analysis, a combination of research paradigms according to the organisational feature under study can expose different slices of the organisational cake and produce complementary sets of data (Hassard, 1993). Within this approach combinations of qualitative or quantitative, interpretivist or positivist dichotomies are proposed but are not always meaningful (Silverman, 1998). What these labels mean within analysis is generally not obvious in information systems methodologies. If they are considered as two different research methods the descriptions of the groundwork and basic assumptions surrounding the analyst activities still remain outside the presentation. In addition, the researcher recognised an often-inflated use of labels like method and methodology (Jackson, 1983), in addition to vague discussions on 'hard' and 'soft' systems thinking. Checkland & Holwell, (1998) have however made a valuable contribution in this area. The lack of a theoretical framework in many studies highlights this issue. A problematic issue with both a 'positivist survey' and an 'interpretative study' as they might be called, is that they both might be based upon an interpretative framework that is not made explicit.

It is difficult to discuss such studies with any meaning, given the very different assumptions and values seemingly built into interpretivist, positivist, 'hard', and 'soft' approaches. Broadly speaking, two major responses to this issue can be expressed. The first insists that the different approaches are isolated and can be used to complement each other. The work of an analyst should thus be divided into distinct parts. Each has its own purposes and is evaluated according to its own standards of rigour. The second tries to blend or integrate aspects of the different approaches from an interpretivist base. It is suggested that (for example) both quantitative and qualitative methods can be executed and evaluated together if the contextually dependent interpretative base upon which both are built upon is inquired into and part of the represented process (Silverman, 1998). It should also be recognised that individual data items are selected for analysis from a whole range of data items available from within a research activity. Additionally, the interpretation of the findings through the approach to analysis and this particular presentation of findings, are necessarily individual and related to the personal experiences of the researcher (Dahlbom & Mathiassen, 1993).

It could be argued that approaches to methodological triangulation, which are purported to have been implemented in empirical research, have excluded a justification and description of any conscious, interpretative base upon which the creative use of the methods has been built. It is interesting that, on either approach, there is a tendency to not only marginalise the qualitative component, but also to avoid any mention of a positivist dilemma. In this thesis, it is argued that such a marginalisation by default might be quite inappropriate and therefore detrimental for the furthering of any theoretical support for organisational interventions. This would be seen as pragmatic results surfacing from those sense-making processes which are supported by the individual researcher's understanding of inquiring approaches into the structures in theory and their constructed relationship with out-acted methods in 'practice'.

Contextual analysis

When considering a possible question of analysis and inquiry: 'What differences in the business - information technology planning process are found within companies multiple viewpoints?' there are several identifiable, underlying questions layered within this inquiry. What is meant by business process? On what basis are the assumptions about different organisations and the following classifications related to the unique, the different and the specific within organisations? How is this justified? Is information system development represented as closely related to information system and information technology process? How are the inquiries into the relevant contextual dependencies made and by whom?

What is meant by differences? If information systems analysis for example is based upon a survey and interpretation of an information system / information technology process, why is no equally represented survey and interpretation of a related business process taken into account? This happens when the business process is taken for granted as it is represented by the corporate management. A further neglected viewpoint relates to the possible difference between business plans and business processes.

If there is no analysis of and in-depth inquiry into related business processes, how is it possible to evaluate any integration between a description of any specific business process and the description of an information system / information technology process? If the integration is evaluated through a relationship between assumptions about business process as presented by senior management or related to industry-type and information system / information technology process this would seem to be a slightly changed question of inquiry. E.g. the focus would no longer be set at the differences according to the specific companies' business process - but it would focus on differences according to generalised assumptions of industry-type business process. This would seem to be inconsistent.

The default case therefore is that the concepts of organisational business process do not scale down to unique individual companies. Or rather as it is assumed in this thesis, the labels seem to be used inconsistently; general ideas of business process versus specific business process is only one of many examples.

In the field of information systems, contextual analysis is described as the analytic part of the information systems development process. It is proposed as a form of analysis of the relationship (e.g. interaction, alternation or a reciprocal action) between the assumptions of contextual dependency and assumptions of information systems development process. Undertaking a contextual analysis if there is no understanding of contextual dependency, or if the dependency is not inquired into or made explicit, could be seen as an inadequate analysis.

Both the 'subject' and the label 'Contextual Analysis' are changing variables and are not to be seen as homogeneous. Nardi *et al* (1996) for example studies context and consciousness in relation to 'Activity Theory' where the emphasis is put on human computer interaction. Pettigrew (1985) has, in relation to organisational issues used 'contextual research' in his arguments for a pursuit of a strengthening of the interdependence between theory and practice. Beyer and Holzblatt (1998) on the other hand mention 'contextual design' in their descriptions of how to do contextual inquiries as a way to create definitions of customer centred systems. Dawson (1994) speaks about contextualist inquiry and relates it to organisational development. Walsham & Sahay (1999) relate to a general form of contextualism and draw upon the Actor Network Theory (ANT) by Bruno Latour for their methodological approach (Latour, 1987; 1999).

Contextual analysis can also be viewed as a relational approach, to work contextually and continually, to continuously take one's surrounding environment into consideration, acknowledging that each situation creates changes in several dimensions (e.g. Agner-Sigbo *et al*, 1993). Agner-Sigbo *et al* suggests that this would include an implicit necessity to, on occasion make efforts to stop, reflect, and use, the experience and imagery of 'rich still pictures' or 'earlier experienced films' as stepping-stones. Such experienced 'prints of realities' are not created or constructed beforehand, but are re-constructed as we experience them. The approach is described as being extensively contextually based and situational over time. The necessity of undertaking projects within a predetermined time can inhibit the extent to which such contextual analysis can be effected. The quantity of information produced could with improper management lead to a situation of information overload. Gunhild, Agner-Sigbo *et al.* (1993) suggest that the detail of analysis should not be too intensive since the analyst would be unable to cope with the information overload. Especially if they are to sketch and build systems with the intention of having those systems working during a reasonable time frame.

Many contextual approaches appear to be pragmatic methods for analysis practice, for example, the work on Continuous Development by Gunhild, Agner-Sigbo & Sissi Ingman (1992) and Gunhild Agner-Sigbo *et al* (1993), and Participatory Design by Ann Hägerfors (1994) and work on Prototyping by Siv Friis (1991). The focused contextual dependencies in these approaches have a tendency towards the local, such as individual and group experiences, collaboration, autonomy and competence.

Simply said contextual analysis implies that phenomena exist in relation to a surrounding, influencing, and multidimensional 'environment'. The missing link in such cases is some form of theory for the identification and description of important factors within the context, although there maybe some kind of impressionistic imprints in use. Contingency theory on the other hand does not always relate to contextual approaches, but it does include some kind of understanding of what the context includes and how it might impact or influence. In general however, contingency theory could be described as having a closer relationship to the organisation as a whole whilst most of the other contextual approaches seem to address individuals and groups. Whilst contingency theory has an intimate relationship to the idea of organisations as open systems other contextual approaches do not necessarily recognise this common ground.

Contingency theory has often been heavily criticised, a key criticism relates to underlying deterministic assumptions, empiricism and weakness of the correlations which are assumed to be established. Other issues of importance are the neglect of power relations by contingency theorists as stressed by Child (1984). Child proposes a strategic contingency approach to organisations. This alternative approach is supposed to focus upon the role of managerial choices in their efforts to actively shape organisational structures in response to contingency. Contingency factors, such as the environment, are, in turn, not treated as independent, but as dependent variables. Such factors can be partly chosen, controlled, influenced and sometimes ignored by a full range of organisations from powerful multinationals organisations and those of lessening power below (Child, 1984).

How users of 'contextual analysis' are supposed to interpret 'context' and if there are particular aspects of the 'context' that are constructed or reconstructed is ambivalent and unclear. Context can be equalled with the closest surrounding 'environment' both abstract and concrete. However in relation to social and cultural open systems, the context could be expected to be both (re)constructed and (re)evaluated. Otherwise it might be argued that a contextual analysis would be irrelevant since one might just as well have used a logical positivistic and objective approach. Furthermore to avoid an unconscious exclusion of for example organisational issues, an inquiry into contextual dependencies might be rejuvenated with sense-making activities such as rational communicative actions and systems thinking built upon both individual and organisational reflexive and critical perspectives (see below for further comments on these issues).

Critical approaches

There are several strands of 'critical' thinking and these are not by default compatible. Work undertaken in the field of Feminism and Contextualism can for example be related with 'Critical Theory' and ICT. The cyberspace in a post-modern and feminist approach has been pursued by Donna Haraway (1985, 1992) and raises the requirement for the critical questioning of difference and boundaries in relation to the impact of new technologies on society. A main strand of 'critical' thinking which often is labelled and generalised as 'Critical Theory' has its origin in 'The Frankfurt School'. This has been further developed by who among others where, the work of Habermas (1984) on the theory of communicative action, and Erik Fromm (1957, 1978) where his normative theory of having and being, are of interest.

Within the field of Information Systems Research, the work of Kalle Lyytinnen (1992), on 'Critical Social Theory' has refined such work. According to Lyytinen the impact of Critical Theory on the Information Systems field has developed in a bi-directional manner, based on a critique of science, the relationships between theory and practice and the nature of social action. Firstly, the work of Habermas (1972) has influenced the discussion surrounding the evaluation of the dominant research paradigm, in his work on knowledge constitutive interests. This work deals with the necessity of the sense-making activity of organisational agents requiring a grasp of the contribution of information system towards environmental understanding. The second approach adopts Habermas's (1984) later work on pragmatics and communicative rationality to develop notions of information system use and development. The taxonomy of social action enlightens understanding of the design, delivery and usage of information systems. Lyytinen identifies six major roles of an information system. These roles focus on the effect of the information system on the efficiency of organisations to order, collect and distribute information. The sixth role however, which is to:

> *'provide a channel for the symbolic interaction and establish an attentive symbolic environment for organisational action'* (Lyytinen in Alvesson and Wilmot (1992))

and relates most strongly to the requirement for the application of Critical Social Theory. This role discusses the notion that information systems induce and create a 'new organisational reality'. Within this role an information system impacts upon the negotiated channels for symbolic interaction and hence the common view of the symbolic field in which they operate. This view of Critical Social Theory in information systems is dependant upon Lyytinen's definition of an information system from Ives et. al. (1980) as a:

> *'computer based organisational information system which provides information support for management activities and functions'*

Such comments imply that the information system is thought of as being a subsystem to the organisation. In other information system research such a conceptual limitation is suggested as being a major inhibitory factor both to the organisational development itself and to the development of the technological information and communication systems (e.g. Bednar 2000, 1999). An alternative view is to equate the organisation itself with an information system. In this view the information system is as inherent a part of the organisation as the actors and the supporting processes.

One other version of 'critical thinking' which might have a major impact on future information systems development is 'Critical Systems Thinking'. This work is closely linked to research on systems in society as presented by Werner Ulrich (1997a, 1997b) which has its background in Systems Science, and the work of West Churchman (1979). It could also be related to Gregory Bateson (1972) among others. Ulrich suggests that systemic thinking can be an active reflective practice:

> *'Reflective practice then is as much a concept of practical philosophy (ethics) as it is one of epistemology (theory of knowledge); it intends self-questioning practice in the ethical sense of a practice that systematically questions its own value implications and lays them open to the critique of all those who may be concerned.' (Ulrich, 2000, p248-249).*

It is quite possible to relate this to the framework for Strategic Systemic Thinking (SST) as described by Bednar (2000). Although both contexts and some of the basic concepts are different (e.g. information systems vs. civil society), the SST framework is intended to support the creation of a contextually adapted systemic thinking inclusive of a self-questioning practice similar to the one mentioned above. Where Ulrich goes on to focus on the interdependence of boundary judgements, observations, and evaluations; a parallel to this in SST could be drawn to the focus on the interdependence of multiple levels of contextual dependencies (such as the relations to inter-individual systems, intra-individual systems, sense-making processes and evaluations). There are however several other differences between the version of systemic thinking as suggested by Ulrich and the systemic thinking implied here. A key difference has to do with how Contextual Analysis through systemic thinking can establish a relationship with Habermas's theory of Communicative Action.

Sense-making as a rational possibility and the pursuit of meaningful communication through 'strong argumentation' based on the competence and reason of agents has been proposed by

Habermas (1984). In the theory of Communicative Action he offers a methodology which rests on assumptions about a 'common' sense base which is supposed to have its origin in 'the public sphere'. Habermasian theory is based upon an idea of rational reconstruction which assumes that all relevant intuitions of competent agents are to be accepted as true and accounted for. The public space as discussed by Habermas is defined as the social sphere where people reason over the realms of life. Since the theory of communicative action can be seen as normative and related to assumptions of an objective reality, it is clear that the theory also might be in conflict with some interpretative approaches and epistemological contextualism. Within the sphere of contextualism however, this means that assumptions of the 'common' are not to be viewed as unquestionable and objective realities.

Alternatively, if the described understanding of the 'common' consensus is replaced with a self-imposed belief of temporal assumptions of such a common consensus the problems of the positivistic trap may be avoided. Avoidance of the built in implications in the theory of communicative action which includes a universal definition of truth (even if this 'truth' might be negotiated) could be seen as essential. In this arena, the suggested temporal and ad hoc assumptions are then to be seen as open for recursive re-evaluations. Such re-evaluation might surface as necessary when the uncertainty and ambivalence experienced by a communicative agent is so strong that it results in a decision by the same communicative agent that a serious misunderstanding has occurred. Since Habermas (1984) acknowledges that the social sphere requires a logic different to natural sciences he suggests an alternative rationalism. The social is presented as being structured around symbols which are then interpreted through an individually constructed inquiry. His idea is that, in using the logic of critical theory, the required inclusions of a systemic analysis of those interpretative schema enables access to the means by which such social action supposedly occurs.

In the reinterpreted version of contextual analysis, an evolved representation of interpretative schemas could be related to an inquiry into contextual dependency. Contextual Analysis is thus to be described as an inquiry into multiple levels of contextual dependencies. In order to make inquiries into contextual dependencies both macro and micro level perspectives enter the realm of consideration. An example of such an effort can be seen in the framework for Strategic Systemic Thinking (Bednar, 2000). This is considered against what Habermas (1984) calls 'undistorted communication' which through SST is re-evaluated and explored as a possibility, as a relative and temporary option, to construct temporal assumptions of 'undistorted communication' but not as an objective truth or necessity.

Discussion and conclusion

In an inquiry and analysis based upon activities related to classifications and interpretations it becomes important to present the basic assumptions which frame the generalisations. The information system and information technology analysis are inquiries into unique individual organisations where the relationship between specific processes could be viewed as being intimately intertwined with the uniquely individual business contexts that those very same unique individual organisations have. The assumptions and justification upon which such transfers from the specific to the general are made should be spelled out.

When treating contextual analysis as an inquiry into contextual dependencies we might expect a reflection on differences between assumptions of 'espoused theories' and assumptions of 'theories in use'. The style of representations of processes all too often does not seem to differentiate between these two aspects even though they might have a major impact on any evaluation of descriptions of organisational activities. There are many reasons why such a reflection is significant in this kind of analysis. Particularly because the discussion seems to equate descriptions of activities in organisations with actual activities in organisations. Such a representational habit or assumptions of indifference should be justified, when they could be challenged by many contemporary theories.

That the primary focus of system analysts cannot be system design but is systems analysis is being supported by the interpretative tradition in information systems research. Soft Systems Methodology also suggests a greater support for the sense making process in analysis activities. Significant emphasis from the information technology industry is put on project management skills ('strong leadership') and requirements engineering, which has a strong relationship with structured systems approaches and formal methods (e.g. Anon, 2000, Menzies *et al* 1999). A traditional and heavy reliance on mathematical and formal methods is less than convincing where such a description does not equal experienced characteristics of the majority of computing activities (e.g. Mahogany & Van Tone, 1990). The lack of reliance in practice on formal methods also has parallels in relation to characteristics and experiences from activities related to organisational change, information systems analysis and development (e.g. Bednar & Wang, 1994). That a belief in rationality and a pursuit of strong managerial control practices in general, is questionable in any kind of organisation (not only in the public services) has been convincingly argued by Chris Argyris (1990). Sven-Erik Sjostrand (1997) who sees the idea of rational management as problematic furthers this notion and that management practice should be characterised as a combination of rational and irrational behaviour. He additionally notes that in order to succeed an ideal manager would consciously practice a combination of both rational and irrational approaches to leadership.

The traditional practice in system analysis and development is all too easily narrowed down to a simple 'lessons learned' activity and allows for little more than 'first order change' and single loop learning (e.g. Bateson, 1972, Argyris and Schön 1978; 1996 on organisational learning, single and double loop learning). Double loop learning and 'second order change' in practice seems to be very difficult to pinpoint within projects; feedback about the sense-making process itself is provided in an ambivalent way, if at all. What surfaces here, although relevant, but which in practice is very problematic, is the required focus on the management of the double loop learning process itself. The nature of practical knowledge and system development strategies in practice suggests that two very significant features of information system research seem to be omitted in information system practice. These relate to:

- the understanding of the differences between organisational design and practice.
- the understanding of the influence of sense-making processes on information systems.

The roots of these problems are not newly discovered, they were initially identified in the 1960's. Langefors (1966; 1995) suggested that interpretation processes and personal pre-knowledge influence all information systems. Some information system researchers (Checkland, 1981; Checkland and Holwell, 1998) have also stressed the uncertainty of problem definitions as having a major impact on information system development practices due to the complex social dimensions of information systems and organisational sense-making.

This thesis acknowledges that the role of the analysts and the represented inquiry is determined by the inquirer's interests and background beliefs, as well as by the questions asked. It is suggested that it should be seen as possible to explore possibilities for a broadening of the interpretative framework in use. Such a broadening activity could be explored through a systemic and reflective sense-making learning process. This kind of understanding of both practice and theory could provide a more robust place for analyst's activities, information systems development and research.

The research issue – Business Process Modelling

The weakness of most process modelling techniques is that they fail to provide an adequate explanation to help problem solvers understand the nature of the object under investigation. They are inadequate, in that they offer little assistance in understanding the way in which information technology systems interact with their environment, and thus the way in which they change and evolve with their environment (Eason, 1988). In (Stamper, 1985) the point is made that garbage in leads to garbage out and consequently it is vital that when starting the modelling process we start from the correct point for information capture and receive both valid feed-back and appropriate information.

Framework for understanding Business Process Modelling techniques

The purpose of a classification

The purpose of a classification is to allow us to identify the strengths and weaknesses of current techniques that are being applied to organisational and in specific business process modelling for information systems. In a more global sense the purpose of a classification is to allow us to say something about the object that we are examining. The choice of a classification schema therefore needs to be pertinent to the area of examination and needs to distinguish between objects.

The objective of classifying the currently used business process modelling techniques against the sociotechnical systems framework (Mumford & Beekman, 1994) is to firstly, identify the attributes of the techniques, and secondly to map those techniques against application domain arenas.

The RAMESES framework will provide the breakdown of the application domain arenas for the juxtaposition of the modelling techniques.

Structure of review

Over the years many methods, tools and techniques have been developed to address the problem of organisational requirements capture and definition for information technology. The business process modelling techniques being described in this section are in serious use today and offer a means by which this complex field of study may begin to be dissected according to the RAMESES framework. The second section of this review will undertake to align the notations, which support these methods again within the RAMESES framework.

Methods for Business Process Modelling

The Soft Systems Method

The Soft Systems Method (SSM) approach to design was initially developed by Checkland (Checkland, 1986). The soft systems method can be seen as a general problem solving approach appropriate to human activity systems. The essence of the approach is an appreciation that for most problems, there are a number of problem statements that may be appropriate, and that the appropriateness of different solutions is largely determined by the particular viewpoints of those people who have an interest in the problem. The soft systems approach provides a conceptual framework to aid in the understanding of how the proposed system will function, along with how the proposed system will be defined. For example, a social security benefits system could be viewed as a system for ensuring that the needy obtain the benefit they deserve, or alternatively it might be viewed as a system for the protection of the "public purse".

Soft system thinking differs most from other approaches based on so called "hard" systems thinking, in that it allows the problem solver to explore the fuzzy and ambiguous nature of a problem and provides a means to discuss change. Soft systems thinking can be seen as the general case for which hard systems thinking is a special case. In soft systems thinking conceptualisation becomes system design, if the problem is sufficiently well defined. Improving the conceptual model sharpens up into optimisation of a quantitative model, and implementing some variety of change, becomes crucial when implementing a designed system.

The viewpoint that one adopts can strongly influence the kind of system that would be thought appropriate, and where such multiple viewpoints coexist in an organisation, a good design will be one that finds a suitable compromise between alternative views. A key feature of Checkland's methodology is the representation of such complex design environments in a suitably '*rich*' way, i.e. rich pictures, so that conflicts of interest can be identified and resolved, or a compromise problem statement reached.

In addition, this method demands that a system oriented approach to design be taken, where design is viewed as the creation of a formal system which must have certain features in common with other systems. These features include having a purpose or mission, a measure of performance, a decision taking process, components as subsystems, a degree of connectivity, an environment, a boundary, resources, and some degree of continuity. Emphasis is placed on describing possible systems in logical terms i.e. with regards to the 'what', rather than the 'how' of what should be achieved.

Checkland's approach has led to considerable debate within systems analysis circles, and appears to be useful where there is a complex design problem. Whilst it is difficult to obtain a measure of its acceptance, it has been utilised in a number of major projects, although, it has not replaced hard systems design methods in any standard methodology. It is however beginning to be more widely used within the U.K. software industry.

Checkland's soft systems methods are of great value when assessing the development of a new system design. However, their usage for the analysis of brown-field sites is limited. The primary factor of organisational understanding is identifying 'what we have already' in order to make sense of 'where we want to go'. This approach has contributed to the development of the RAMESES framework but does not offer an independent solution.

SSADM

The SSADM (Structured Systems Analysis and Design Method) method (Ashworth, 1991; Ince & Andrews, 1991; Longworth, 1989; Nicholls, 1987) is a structured methodology in that it attempts to address four questions that continually arise in the process of systems development.

- What is the system to do?
- When should it be done?
- How should it be done?
- Where is the information to be recorded?

SSADM, whilst complementing other development activities, does not encompass them all. Each stage is broken down into a small set of steps, which define the inputs, outputs and tasks to be performed. The product of each step and the interface between each step is clearly defined in the SSADM documentation. Each step serves to define a clear set of methods that can be used to achieve the overall goal of that step. The stages in SSADM follow a clearly prescribed linear sequence and SSADM methodology forces a problem solver to follow this sequence. SSADM starts at stage one *Investigate Current System* and finishes in stage six *Physical Design*. Figure 1 entitled *The SSADM Method*, describes the six stages that a problem solver would engage in using the methodology. What is not shown in Figure 1 is that from any stage there is a set of feedback loops back to all of the stages that have gone before.

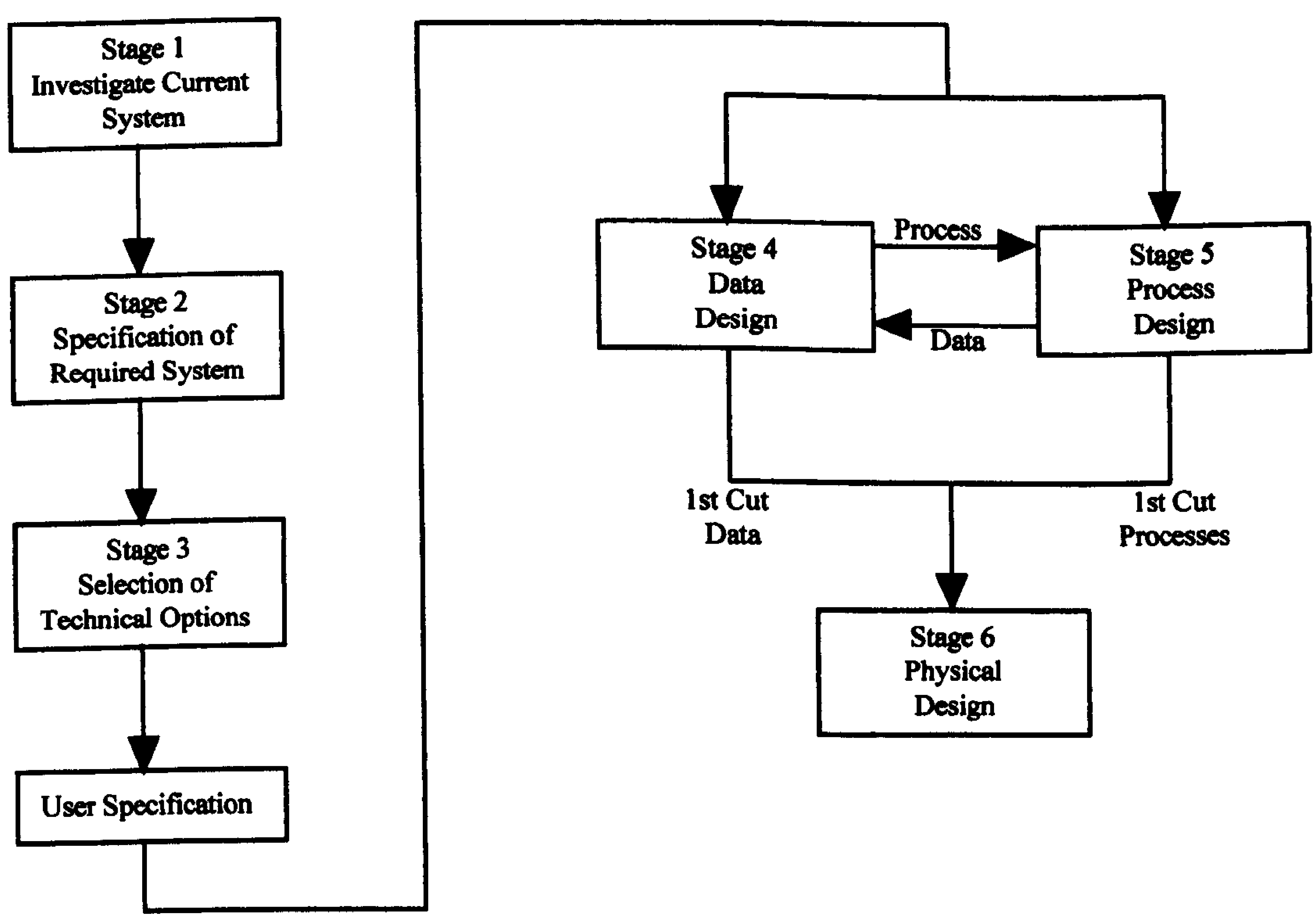

Figure 1: The SSADM method

The first stage in the SSADM method is called *Investigate Current System*. This serves to allow the problem solver to learn the terminology and function of the system user environment. It will allow the problem solver to see how the current system works along with examining the data flows that exist within the system and the informational concepts which the new system will need to support. The second stage is called *Specification of Required System*. In this stage the problem solver will construct a specification of the new system. This will be based on the information that was gathered in stage one and in consultation with the problem owners. The third stage, *Selection of Technical Options*, serves to generate a set of possible technical solutions to the problem. Each solution will be carefully costed and evaluated against each other. Stage four, *Data Design*, will define the logical data design of the system such that all the required data will be included in the system. Stage five, *Process Design*, develops the definition of the system defined in stage two to a low level of detail so that an implementer can be given the necessary details to build the system. Finally in stage six, *Physical Design*, the complete data and process designs are converted into a design that will run on the target machine.

SSADM also employs a set of techniques (Ashworth, 1991; Ince & Andrews, 1991) that can be used at various stages in the methodology life cycle model. The rules of the syntax and notation of each technique are supplemented with guidelines on how it should be applied in a particular step. The diagramming techniques that can be used within SSADM are Data Flow Diagrams (DeMarco, 1979), Logical Data Structuring, Entity Life Histories and Logical Dialogue Design. In addition SSADM also has a set of non-diagrammatical techniques including Relational Data Analysis, Quality Assurance Reviewing and Project Estimating. The SSADM methodology as it stands is a soft system methodology, in that it recognises that for any problem there are a number of different design solutions that may be appropriate. The appropriateness of different solutions is largely determined by the particular viewpoints of those people who have an interest in the problem and its solution. The methodology demands that a system oriented approach to design be taken, where design is viewed as the creation of a formal system which must have certain features in common with all other systems. Obviously a key feature in this methodology is the ability to represent and detect conflicts of interest from the viewpoint holders.

The SSADM methodology offers a particular 'objective' viewpoint or representation of the organisational environment. Whilst it offers a soft systems approach to organisational description it is most effective in a hierarchical and structured environment. Within the scenarios provided by SMEs many are of a different organisational structure than those easily accommodated by the SSADM methodology. It is difficult to apply SSADM to semi or unstructured environments as the notation forces the data into hierarchies which may not exist.

Jackson Structured Development

Jackson Structured Development, JSD (Cameron, 1986; Ince & Andrews, 1991), is a widely used method for the development of real-time data processing and simulation systems. The technical aspects of the development are divided into three phases.

- The Modelling.
- The Network.
- The Implementation.

The modelling stage forces the problem solver to examine not only the set of informational concepts that the proposed system is to encapsulate, but also the set of entities over which encapsulation will occur. The problem solver also considers what the constraining rules on the concepts are, along with what attributes should be associated with each concept or the manipulation of each concept. The modelling stage is thus used to identify both the processes and data, that the data processing system is to support. The modelling stage produces a set of actions, entities, attributes and rules. These objects are identified at a very abstract level and later refined. They are then used as input for the network phase. JSD views a system as a set of communicating processes, where each process holds its own local data and the processes communicate via message passing. The network phase refines the ideas and objects presented in the modelling phase in order to produce a system specification that is then used as input for the implementation phase. In the implementation phase, two main issues are addressed; how to run the processes that comprise the specification and how to store the data that they contain. Thus the implementation stage takes as its input a specification produced by the network stage and produces as its output the final data processing system.

JSD views systems as a set of communicating processes and does not take into consideration how the user's environment will be changed. JSD also does not support the idea of problem owners holding views of the problem and thus of the system. JSD whilst being a leading methodology for the design of real-time systems offers little insight into organisational reality and environmental understanding.

Role, Function, Action Nets

The Role/Function/Action-Net (RFA-Net) method was first presented in (Oberquelle, 1998), and views organisations as communication processes. This method forms part of a larger class of methods concerned with Business Process Re-Engineering - BPR (Davenport, 1993). BPR methods are concerned with re-structuring and re-engineering organisations so as to increase their performance. This re-structuring and re-engineering often involves the development, or re-engineering, of the organisational information system.

Role/Function/Action-Nets are a visual framework for the elicitation, representation and validation of requirements. They achieve this goal by the modelling of an organisation at three conceptual levels: the role level, function level and action level.

The role level concentrates on the pragmatics of work. A meaningful task for a person is called a *Role*; the person is called the *Role Player*. A role comprises the responsibility for the task and the rights and duties with respect to other roles and their role players. One Person may play many roles, each role being called a *Sub-Role* and every role contains at least one function.

On the function level we concentrate on the static organisation of work. A function conceptually comprises one sequential activity and its local resources. All functions are performed by *actors*; each actor may be a person or a machine. A function may access objects and data located in positions. The totality of positions constitutes the organisational space. The local space of a function is called its depot. The space that functions have in common with other functions is called their interface. Functions interact with each other by the exchange of objects or data. An object is considered to be a set of individuals with some attributes and data is considered to be an attribute stored in an object.

The action level concentrates on the dynamics of the work processes. The simplest unit of activity is called an elementary operation. Operations are actively executed by actors and can be used to modify objects or data. The relationship between the operators and the actors is called the control aspect.

The RFA net approach allows a system designer to explore the way and thus the consequences of the way in which people within an organisation interact, how they do their work and what objects and resources have to be present within the system for them. All this aids the system designer in the task of capturing the system requirements. This approach offers a valuable means of eliciting information with regard to the 'socio' aspect of the sociotechnical systems and the RAMESES framework.

The SAMM method

The Systematic Activity Modelling Method, SAMM (Lamb, Leck, Peters & Smith, 1978; Stephens & Tripp, 1978) was developed by the Boeing Computer Services Company. The objective of SAMM was to model an information system using hierarchical decomposition and data flow. The resulting language is a combination of graphics and graph-theoretical notations. The SAMM specification technique is based upon the idea of specifying and decomposing the activities that people within an organisation engage in. A SAMM specification consists of a context tree, a set of activity diagrams and a condition chart.

The context tree is the hierarchical structure that is used to rank activities. It is used to organise the refinement of an activity into its sub-activities. It is possible to map from a context tree to an activity diagram quite easily. The context tree allows a system designer to engage in a top down design process, and thus aids the designer in the task of refinement. An activity diagram consists of a description of sub-activities and a data table, as shown in Figure 2

The activity diagram that is shown in Figure 2 depicts the activity (function) of compiling a list of names and then extracting from that list the most common surname and Christian name. The data table is made up of data descriptions with indices and is shown on the left of the activity diagram. In the activity diagram a sub-activity is referred to as an activity cell and is represented as a rectangular box. The data flow is drawn as arrows going from one activity cell to another.

Then, having organised the tasks into a context tree, an activity diagram can be used to capture the data flow that exists between the various activities. Once this goal has been achieved the behavioural properties of each activity cell can be specified using a condition chart. The SAMM technique fails to capture the notion of views or projections of a system by implying that the problem is fixed and that everyone shares the same definition of what the problem is.

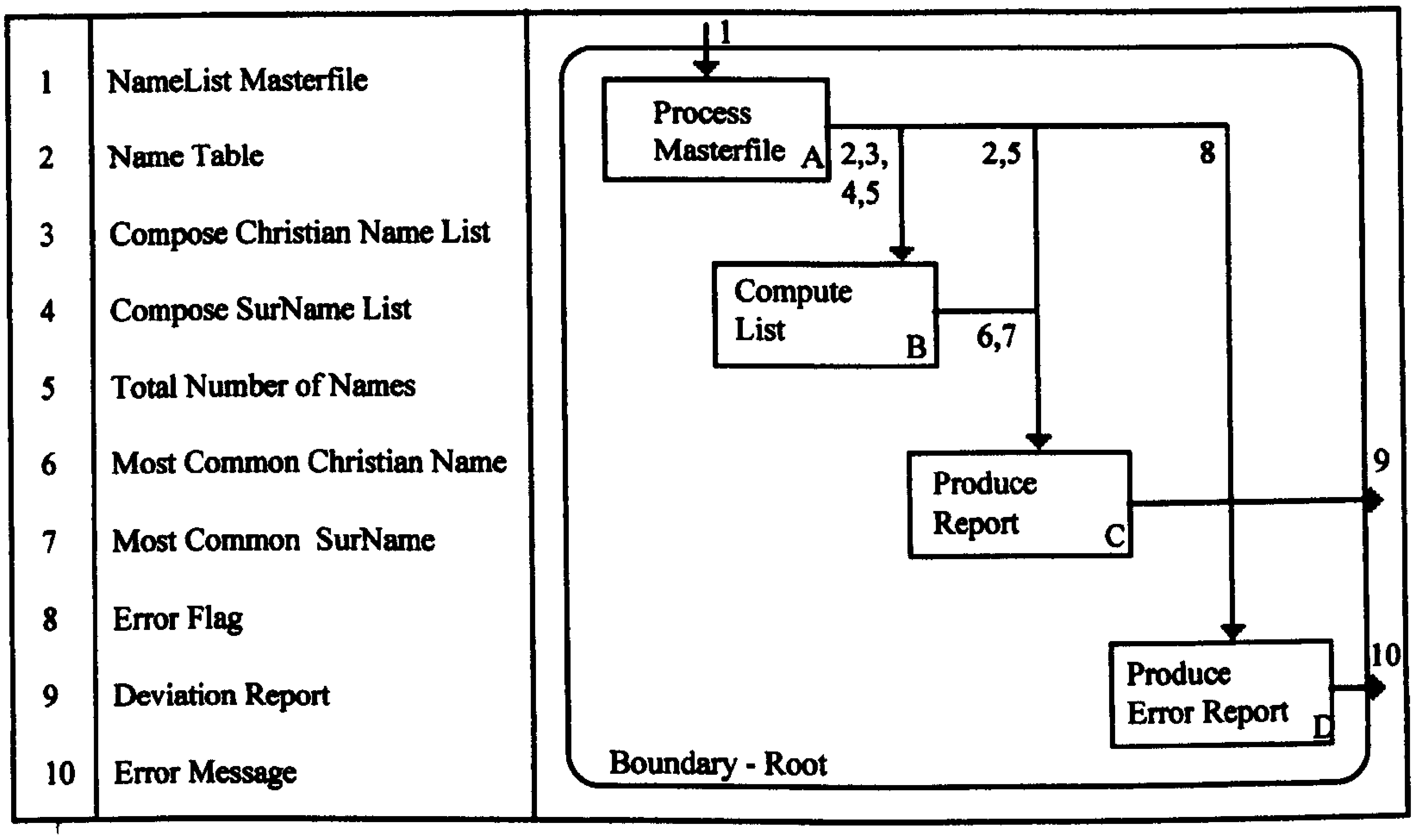

Figure 2: A SAMM activity diagram

The SAMM methodology relates to the RAMESES framework in that it can aid in the collection of the MACRO view of the organisation. The top down approach is the first viewpoint to be taken and offers the base line upon which subsequent comparisons will be drawn.

Discussion of methods in general

In this discussion some methods that have already been reviewed will be discussed in addition to some which have not been reviewed. When viewing, analysing and understanding methods it is important to comprehend not only the political concepts embodied within each method, but also the political system within which the method is to be used. It is also important to understand the view that the method has of the world and the problem within that world that the methodology is trying to solve.

Hard systems analysis methods such as JSD (Jackson, 1983) view the computer system as a pure computational object. These methods were developed in or around the 1960's when computers were big boxes that lived in large rooms and were used mainly as number crunchers. They place emphasis on the information requirements of the system. These methods commonly focus on the flow of information through a given environment and the different entities of which it is composed. They view an information system as an input process connected to a computational process connected to an output process. The goal of these methods is to specify a) the required input b) the transformations that may be performed upon that input and c) the output produced by the transformations. Critics make the point that hard systems design methodologies are based on pseudo objective models of systems and suffer from two faults. Firstly the representations used by the analysts only contain what the analyst thinks is important, and secondly analysts tend to fill in gaps in available information using their own intuitive judgement. Hard systems methodologies view the process of problem solving as being deterministic. They also view the process of problem solving as being a clear linear sequence, which defines how the problem and solution will evolve and ultimately be defined.

Object oriented analysis and design methods such as (Booch, 1991; Coad & Yourdon, 1991; Rumbaugh, Blaha, Premerlani, Eddy, & Lorensen, 1991), have been applied to both business process re-engineering (Davenport, 1993) and analysis and design of organisational information systems. The methods in general view the system as a set of interacting objects, where the interaction is of the form of strongly typed parameters passing through service invocations. These notations on the whole have been designed by computer scientists for computer scientists and do not support the 'socio' aspects of the 'sociotechnical' system.

The Scandinavian style of methods can be viewed as empowering the problem owners through education and the free exchange of information. This style of method has been slowly gaining in popularity and is now used in Europe and North America. The ISAC method. (Avison & Fitzgerald, 1988; Lunberg, 1982) is a problem-oriented method and seeks to identify the fundamental causes of the problem. The approach taken by the ISAC methodology is designed to analyse problem owners' problems and to solve aspects of them where appropriate. The ISAC approach to problem solving is to educate the problem owners by helping them to understand better the nature of their problems. The ISAC method is a stepwise methodology that starts with trying to understand the problems that are facing the problem owners. It then goes on to analyse the information structures that exist within the current system and finally ends with the system delivery stage. The key difference between ISAC and other methods is that it directly places in the problem owners' hands the task of problem identification and supplies the tools and techniques to achieve this.

Socio–technical systems theory stresses the loss to overall effectiveness of any endeavour, which concentrates unduly on technical considerations by excluding or minimising the motives and skills of people who are required to interact with the technology. Human characteristics and needs must be considered in the specification if a system is to be effective from both the technical and human perspective. A number of methods have been developed around the theory that specifically address human issues in design, e.g. ETHICS (Avison & Fitzgerald, 1988) PORGI (Kolf & Oppelland, 1983), OSTA (Harker & Eason, 1985), Pava's Sociotechnical Design Methodology (Pava, 1983) and IT-UPTAKE (Ryan, Wynne, Cullen, Ronayne, & Dolphin, 1988) Characteristically, such methods include specific techniques to assist in identifying the needs and requirements of different classes of users of IT systems, and provide ways of identifying the human implications of design ideas.

Discussion and further work

The RAMESES framework under which the classification of approaches to business process modelling is being undertaken rests of the sociotechnical systems approach to organisational analysis. This approach seems most the most appropriate means by which sense making activity of the SME environment can be undertaken. It is essential for the ongoing improvement of SME activity that all organisational factors are understood prior to decision making with regard to problem areas. Most SMEs do not enjoy the benefit of highly trained computer professionals to aid them in understanding the complexity of their operations. To this end a method is being developed which can bring some of the benefits of professional aid into the reach of such organisations. Many SME directors use a highly intuitive means of decision making. It is the objective of this framework to help make explicit and therefore accessible some of the tacit understanding which supports everyday sense making activity.

Modelling specification languages

PSL/PSA

PSL (Teichroew & Hershey, 1977; Tse & Pong, 1991) (Problem Specification Language) was designed and developed at the University of Michigan in the ISDOS project. PSL was designed to allow a system designer to specify a set of requirements formally and then analyse them automatically (PSA). A PSL statement will cover the system behaviour, system structure, data flows, system dynamics, data structures and project management. The semantics and syntax of PSL is based on the entity relationship approach (Chen, 1976). PSL supports a multi-level refinement process, so that systems can be specified in a hierarchical manner. In a PSL specification the logical attributes of the system are separate from the physical attributes of the system. PSL was not designed for a particular system development methodology. It can only be input as a textual language, which can then be used to generate a set of graphical reports. There is however no one-to-one mapping between the graphical reports and the textual input. The graphical reports serve to provide a means for presenting the specification back to the problem owners for validation and to aid further the problem owners in their task of requirements engineering.

PSL/PSA was developed to aid in the analysis of the behavioural and functional aspects of the system. The interface is such however that it would be an unsuitable tool for inexperienced users and therefore inadequate for the purposes of the RAMESES project.

Data Flow Diagrams (DFD)

A data flow diagram, DFD (DeMarco, 1979; Dennis, 1974) , is used to describe at a high level how data is transformed as it moves from one system component to another. It documents how data as input is transformed into data as output. In essence data flow diagrams are made up of three components.

- Data Flows (Annotated Arrows)
- Transformations (Annotated Bubbles)
- Logical operators * and ~

The annotated bubbles represent transformation centres with annotation specifying the transformation. Arrows represent data flow in and out of the transformation centres with the annotations naming the data flow. The two operators are used to mean AND and EXCLUSIVE-OR. The notation allows for decomposition of transformations into sub-transformations. Consequently data flow diagrams promote the principle of hiding unnecessary complexity.

It is important to note that a true data flow diagram contains no control flow or sequencing information. One of the principle advantages of data flow diagrams is that they allow the problem solvers to examine how data flows through, and is transformed by, the system without specifying any implementation details.

DFDs view the world as a series of flows and transformations; as such they can aid the collection of specific aspects of business processes representation. Their inability to handle sequencing is a drawback within the RAMESES project. Another problem is that they offer no role analysis and as must be used in conjunction with other methods if a comprehensive understanding of a process is to be made.

Other formalisms and languages

There are several other pieces of work that have been done on requirements specification formalisms that are worthy of mention. **PAISLey** (Zave, 1991) is an executable specification language based on the functional programming language model of computation. PAISLey combines formal representations of both data and control flow and thus the language has a formal semantics. The idea of using **Petri** nets has also been used to model office information systems and thus capture requirements (Beslmuller, 1988; Rein & Singh, 1992) . Petri nets can be used to show how functions are related and thus depend on one another. Using Petri nets the state changing operations associated with the system can be modelled and analysed. Through the use of PAISLey and Petri-Nets we can analyse the information flows, computations and transformations associated with the system.

The idea of exploring and specifying a problem has been explored and examined and various notations have been suggested like **Z** and **VDM**. These notations however are all built on set theory and first order predicate logic. In (Lee, 1988) a formal system is presented that will allow a system designer to specify a problem. This formalism is built on deontic logic. Deontic logic has two operators, the obliged and permitted operators represented as an **O** and **P** respectively. It is however possible to specify one operator in terms of the other.

Using deontic logic it is possible to examine some aspects of the way in which people within organisations work. (Lee, 1988) also presents the simple languages DR and PN for the processing of deontic rules; DR is an applied form of a logic programming language and PN is an extension to DR to accommodate the dynamic aspects of organisations. A system designer using DR may examine the consequences of a particular specification of an organisation.

SXL (Lee & Sluizer, 1991) is an executable modelling language that describes systems behaviour rather than software structure. Using a conventional state transition framework, model behaviour is determined by rules that define pre and post conditions for each transition. Behaviour can also be specified by constraints, logical invariants that are automatically enforced during the execution of the model. The intended purpose of the language is to provide a simple model that directly corresponds to the informal and high level descriptions from which it is derived. Rules and constraints are expressed solely in terms of entity relationship structure and declarative logic. The language lacks machine oriented data and control structures and has no facilities for specifying or implementing software. A system designer can thus capture requirements about the systems behaviour without making any design decisions.

Diplans (Holt, 1988) are the expression of a graphical language used to describe plans of operation in human organisations. Just like any other task co-ordination takes effort. Yet it is upon co–ordination that most organisations are built. What a Diplan attempts to do is to model the way in which people interact with each other and their relationships with each other. Another model of co–operation is that of Interconnected Roles (Singh, 1992) . In this notation the concept of role is mixed with that of Petri nets to provide an executable model of how organisations function. In (Singh, 1992) a role is viewed from a functional perspective as a precise functional specification of a piece of behaviour. Both Diplans (Holt, 1988) and Interconnected Roles (Singh, 1992) allow us to model and analyse information flows.

SAMPO A notation for the modelling of organisations using speech acts is presented in (Lyytinen,Auramaki, & Hirschheim, 1991) along with a method SAMPO (Speech Act based office Modelling aPprOach) to aid in the construction of the model. The idea of speech acts was first described in (Austin, 1962) and later developed in (Searle, 1969) . In (Auramaki, Lehtinen, & Lyytinen, 1988) a graphical front end is added, this allows a systems designer to explore how, and in what way the people within an organisation interact. It is possible to examine how commitments are established within and flow through the organisation, as well as to examine what objects act to signal the establishment and discharge of commitments. Although the information captured by these methods are valuable, these organisational modelling techniques suffer from being too complicated to use and too difficult to understand.

Conclusion

Researchers in the area of software engineering have for a long time used formal methods as a means of specifying systems. The belief is that if the system is specified correctly using certain logics then various theorems about the properties of the system can be tested. In addition, a validation function may be performed on the system to check that the developed system meets the specification. The problems that have confronted formal logic researchers have primarily been concerned with how a correct specification is constructed. Specification languages such as Larch (Guttag, Horning, & Modet, 1990) , Z (Spivey, 1989) , VDM (Lucas, 1987) , OBJ and CLEAR (Goguen & Burstall, 1977) all draw upon various logics to aid in the construction of a specification. By considering purely functional aspects of the system they fail to capture correctly the context and thereby the environment of the system. In limiting their view of the world to a purely functional one they miss all of the non-functional information that is so important in defining todays systems.

None of above, however provide any type of methodological framework to aid in the process of specification construction. The problem facing many people using these notations is one of constructing and validating a specification that accurately reflects the needs and values of the system owners and system users.

Various diagrammatic notations have been developed to aid in the requirements engineering process. These range from informal notations like Role/Function/Action-Nets (Oberquelle, 1998) and SAMPO (Auramaki et al., 1988) that draw upon social concepts to aid in the construction of a specification, to the more formal notations like Petri-nets (Beslmuller, 1988) and Role Interaction Nets (Rein & Singh, 1992) that draw upon formal systems to assist in the construction of a specification. All of the above have failed to address the issue of cognition of usage. They all present complex diagrammatic notations that draw upon various formal notations and which are very difficult for an untrained and unskilled person to pick up and use and therefore have little to offer the users within the SME environment.

The relationship between BPR, small organisations and process modelling

This section of the literature review examines the relationship between the BPR literature, small organisations and the need for process modelling. It is in this vicinity that this thesis is situated. Accurate, and more importantly, meaningful process modelling can aid organisations in understanding their processes and therefore their future system requirements. The understanding of the current state of an organisation is a pre-requisite for useful action.

Process focus to change

The focus of BPR consisted of enterprise-wide process constructs (Tinnilä, 1995), and cultivated ideas of information and knowledge, since the latest technology would only be beneficial if it could help people to work better (Martinsons and Revenaugh, 1997). Instead of identifying a great number of processes as potential for improvement concentration is on what Tinnilä (1995) regarded as the four fundamental processes of technical, innovation, enabling, and social aspects which could be transformed into strategic capabilities providing superior value to customers. This type of model of the organisation, including its functions, processes was also advocated by Teng and Kettinger (1995). Hence, business processes were considered an object of strategic planning on the basis that these were building blocks of corporate strategy rather than the products and their markets (Tinnilä, 1995).

A process-oriented viewpoint of BPR to remove non value-added activities from the traditional functional hierarchical structure was also proposed by Parnaby (1994). Parnaby (1994) suggested looking at the core process and reorganising around these. The organisation should install effective control structures and use all available tools to redesign the organisation and support its operation. Parnaby (1994) also suggested sub-dividing core processes into subsidiaries as the amount of staff in organisations was usually too large to operate as a single unit, though small organisations could be an exception where sub-division was not required. It is here suggested that, this needs to be explored further to examine whether process modelling in small organisations was similar to that described in the literature for large organisations.

However, Taylor (1995) regarded the mechanistic viewpoint of IT as the enabler of change as being in opposition to the largely political view of an organisation where a business process is tied up with the organisation, and is infused with both the formal and informal power of leaders. Thus, the human element of reengineering also considered the theoretical aspects of BPR. Business processes are seen as a repository of human capabilities that contribute significantly to the well being of organisation. The organisational memory is fundamental or perhaps unique to the capability of the organisation. This organisational knowledge can also provide powerful strategic awareness and competitive advantage. Thus, the technical view of BPR can be considered as both ignorant of politics and the value of the organisation's embedded knowledge.

Organisation components that make up business processes mutually accept and agree their respective roles in that process and the necessary resource exchanges between themselves. When disruption occurs and the truce or consensus breaks down then the business process can be severely disrupted as a state of 'domain dissensus' takes over (Taylor, 1995). Information is central to this concept, definition and practical existence of domain, though whether the unit of analysis of organisational domain was department division, group of workers, etc. remains unclear?

The concept of information domain offers specificity that the concept of organisational domain lacks. In any organisational change process the domains of the organisation will be active, positively or negatively, and information holdings and flows will be used either to legitimate or to challenge the process. The concept of information domain is central to understanding the politics of the organisation, and the politics of organisation are central to understanding process of community and change. Business process change should therefore consider the politics of the organisation and not presume that an apolitical environment can be created by the application of technically rational management tools. Taylor suggested that on this view no radical approaches to BPC such as BPR can be technically rationalist; it will be conceptualised, designed and implemented in accordance with the political behaviour of the organisation to which it is being applied.

Consider existing structures

Thus, Taylor (1995) disagreed with Hammer and Champy's (1993) view of obliterating existing organisational structures. This has a high risk of irreparability and may detrimentally damage the knowledge base of an organisation. The experienced workforce, with long-standing grasp of organisational practise and process, will be removed, and the unique set of capabilities and competitive advantages flowing from them will be lost. The BPR exercise should 'informate' the organisation (Taylor, 1995). Organisations should be made ready for radical change which should not be all out obliteration, but careful and thoughtful preparation essential as prelude to recognise politics and also existing human asset base. A paradox of this is the way that the human knowledge-base may act simultaneously to frustrate programmes of deep transformation, with politics intruding on knowledge and vice versa. Information domains, or "epistemic" domains representing several knowledge bases of accumulated memories combined with the skills of the organisation resident within fragments of its specialist workforces, shaped the strategic understanding of the organisation and were powerful voices in the definition of resource requirements, IT and strategy.

For Taylor (1995), the way that management can best prepare an organisation for change is to break down epistemic domains not with heavy handed and possible politically damaging BPR, but with use of new systems which are designed to give shape to an organisational 'information commons'. If existing information structures secure epistemic domains and provide a basis for organisational politics, then investment in new 'front end' systems designed to provide pathways around previously discrete information holdings, which thereby enable wider use of hitherto specific information, can be one tool for developing readiness to change. By laying emphasis upon common data specifications across the organisation, developing organisation-wide communication infrastructures, and boosting cross-functional working, an organisation can prepare for the possibility of change. Indeed, measures such as these may well give rise to bottom-up pressures for change from within the organisation as the knowledge-intensive workforce establishes new perceptions of ways to 'do things better', and as such the old political structures dissipate.

Systems developments in organisations have given rise to limited rather than extensive access to information. Organisations and employees remain largely in a state of information poverty. Creating readiness for organisational change must spring, not from an industrial age paradigm, which proceeds in ignorance of the human content of an organisation but from an information age paradigm where emphasis moves away from the 'machine model'. The move should be towards one that stresses the need to lower internal barriers to organisational change, to develop intelligence of the organisation and to manage an information strategy aimed at "information empowerment" as a form of 'unplanned' re-engineering of management processes (Taylor, 1995).

For Francis and MacIntosh (1997), the old hierarchical structures were no longer adequate, though there were different degrees of the process model. The danger existed of replacing vertical with horizontal barriers and suggested that the matrix structure was possibly a conservative approach. Employee motivation was a further concern as regards promotion in a flatter structure, since there was often just one case manager for a process. The future pattern for career paths could resemble that of professional bodies with various degrees of partners who would be responsible for more complex tasks as they progress.

Functional role in business processes

Teng et al (1994) proposed the model indicated in Figure 3 to determine the functional coupling in a process to help understand how the related functions participated in business processes. The level of functional participation can be differentiated along two dimensions - degree of mediation and degree of collaboration. They defined mediation as a sequential flow of inputs and outputs among participants in a process. Each function has a number of inputs and outputs in a process that range from a high to a low degree. Some business process contain several indirect steps and are therefore at the high end of this scale, whereas others contribute directly to process outcome without the mediation of sequential steps and are therefore at the low end. There are various levels in between two extremes.

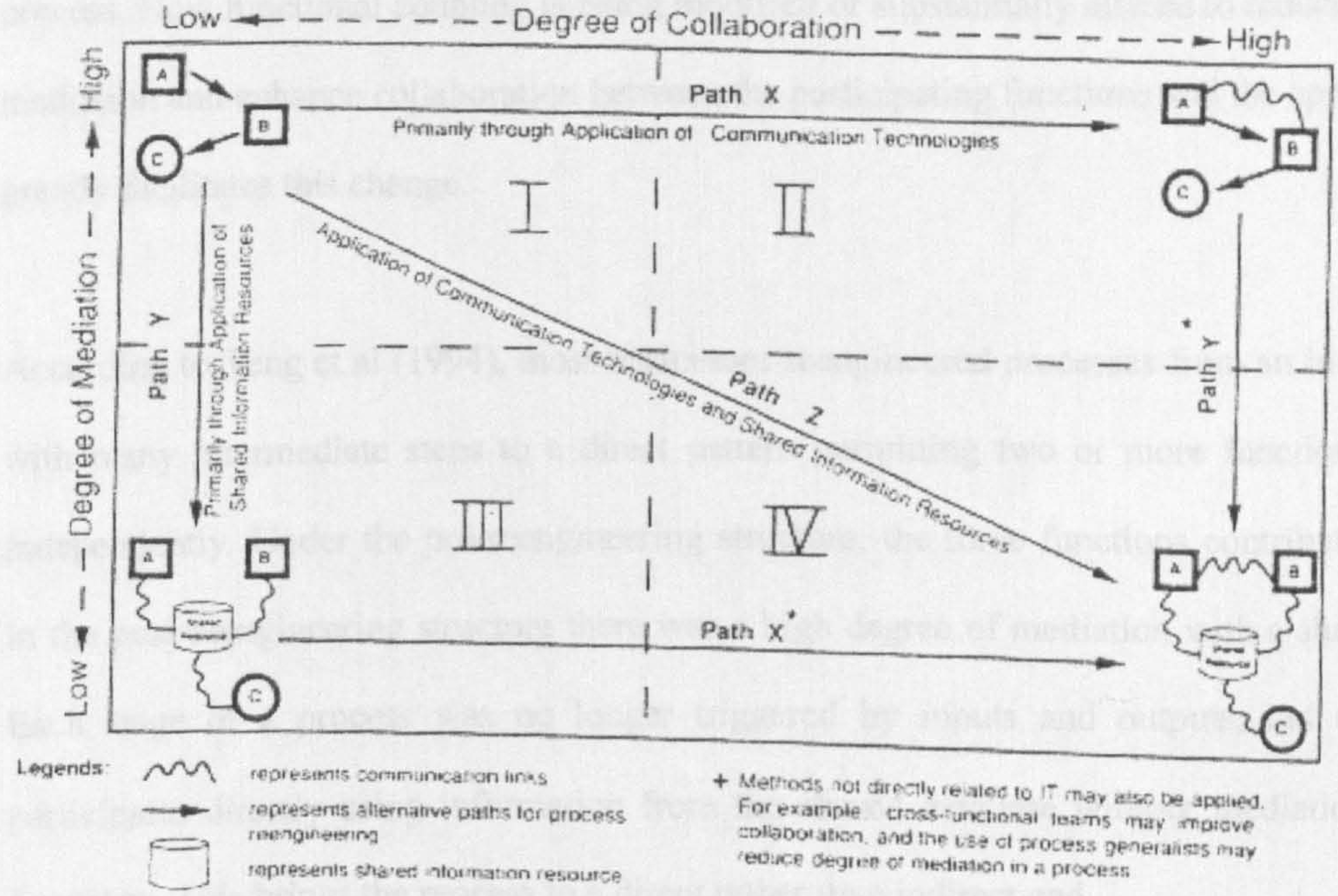

Figure 3: Process functional coupling model from Teng et al, 1994

Meanwhile, collaboration is related to information exchange and mutual adjustments when participating in the same process. The degree of collaboration ranges from none (completely insulated) to extensive (highly collaborative). However, there are possible undesirable consequences of insulation, such as a new design, and problems associated with a lack of communication between design engineers and production. Four levels of coupling are proposed: indirect-insulated, indirect-collaborative, direct insulated, direct collaborative, which indicate the level of participation in common processes to produce a process outcome. Traditional processes evolved in an environment with limited uncertainty, where the output of one function could be specified in advance to meet the input requirements of another. Two functions could participate in the process without contacting each other and making adjustments. However, standard rules and procedures are nowadays rendered as too inflexible where the penalty for an isolated function is the possibility that its output would be unsatisfactory or even useless to other functions in the process. Now functional coupling is being modified or substantially altered to reduce unnecessary mediation and enhance collaboration between the participating functions and the application of IT greatly facilitates this change.

According to Teng et al (1994), most businesses reengineered processes from an indirect pattern, with many intermediate steps to a direct pattern permitting two or more functions to proceed independently. Under the pre-reengineering structure, the three functions contributed indirectly. In the post-reengineering structure there was a high degree of mediation with a shared database. Each stage of a process was no longer triggered by inputs and outputs, but each function participates directly using information from the shared database without mediation from other functions. This brings the process to a direct rather than indirect end.

This use of shared IT to reduce the required level of mediation is powerful testimony to the distinctive value of IT (Teng et al, 1994). Shared information may retain its value after additional use, which can be useful for future users. Collaboration becomes discretionary whereas previously, input and output relationships were often dictated. Each function develops the option for collaboration, which makes IT-enabled collaboration especially appealing as changes to underlying mediation are not always necessary. Technologies have a great potential for improving communication and collaboration between different functions involved in a business process by allowing several users to work simultaneously, and hence to develop a high level of collaboration.

The functional coupling framework thus provides a basis for identifying critical characteristics of a business process that may be altered via radical approaches to BPC, such as BPR through the applications of IT. There are a number of alternative paths to BPC and guidelines are needed to select a strategic path. Before developing guidelines, Teng et al (1994) stated that it was important to recognise that it is possible to chart the "right" reengineering path for the "wrong" process. As BPR is capable of achieving breakthrough performance, it should be approached as a strategic endeavour.

Identify processes for change

The primary factor for change involves determining the processes that were essential or desirable to achieve an organisation's critical success factors. Indeed, for Kettinger et al (1996) understanding and measuring processes was the critical step in BPR, since to ensure the outcome is successful, it is necessary to establish criterion of effectiveness. Kettinger et al (1996), were also concerned with the efficiency of the process to minimise the resources needed to produce an outcome. The success of BPR depends on a thorough understanding of how the process works and with what resources. Tinnilä (1995) suggested that process development should commence by defining the desired strategic objectives and then redesigning the organisation and its operations accordingly. Unless strategic definition preceded reengineering, the focus of effort would be too narrow. Davenport and Short (1990) also suggested that most organisations could benefit from total redesign rather than selecting a few key processes, although complete organisational redesign was often untenable due to insufficient resources.

Teng et al (1994) stressed that not all processes were candidates for reengineering, since some processes can remain sequential if they operated in a stable environment without the need for collaboration. In order to ensure that the correct processes were reengineered, Teng et al (1994) further suggested identifying processes critical to an organisation's strategic objectives, and then plot them on the functional coupling model illustrated in Figure 1 to determine the current levels of collaboration and mediation. There were four possible assessment outcomes:

- Low Collaboration-Low mediation
- Low mediation-high collaboration
- High mediation-low collaboration
- High mediation-high collaboration

For example, Path X & X* in Figure 3 is suitable for processes with insufficient collaboration and where potential for collaboration enhancement is high. Meanwhile, Y & Y* is suitable for processes with high potential for mediation reduction where many sequential steps can be eliminated. Different types of processes, such as operational with sequential steps are good candidates for Y to take advantage of shared data and a knowledge base. Many processes settled in III in the grid in Figure 3 without the need for further collaboration on X* to reach IV. Managerial processes were rooted in higher level of uncertainty and a relatively unstructured nature of the process. Managerial processes in I modestly improved to II through e-mail & GroupWare applications. There are also additional factors to consider along any path, such as the technical, economic and operational feasibility of implementing reengineering project along any path. In addition, Teng et al (1994) thought the risk factor was important, since the more radical the change, the higher the risk for unsuccessfully implementing change.

In networked organisations where information flows blurred traditional intra-company boundaries, recent research, according to Teng et al (1994) has indicated that advance IT applications would initially allow organisations to increase the amount and effectiveness of collaboration with existing structures. The innovative use of IT would lead many organisations to develop new, co-ordination-intensive structures, enabling them to co-ordinate their activities in ways that were not possible before. IT enabled changes on the two horizontal/vertical paths, X, X*, Y and Y*, in Figure 3, but the diagonal route Z would potentially enable a new co-ordination-intensive structure.

The selection of the appropriate path for BPC requires careful assessment of the process with regard to its potential for collaborative enhancement and mediation reduction (Teng et al, 1994). As organisations focus on BPC, it is important for management to comprehend the implications to the organisational structure which may lead to resultant improvements in competitive advantage. The consequence of the traditional hierarchical structure of organisations prior to undergoing radical change resulted in information poverty, whereas the post-reengineering structure now results in information richness (Teng et al, 1994).

Relevance of business process change to SMEs

Another notable omission from the literature on BPC is the lack of case studies on change in SMEs (Hale and Cragg, 1996; Francis and MacIntosh, 1997). There are a limited number of papers that referred explicitly to small firms (for instance McSwinney, 1995; Hale and Cragg, 1996, University of Plymouth, and work conducted at the University of Warwick), in comparison with BPR in large organisations (McSwinney, 1995). This is particularly the case for radical approaches to change such as BPR. The results of a literature survey conducted by Francis and MacIntosh (1997) showed a marked absence of reported cases of BPR by SMEs amongst the 45 case studies found. The majority of literature on BPR implementation has used the case-study approach on one or two individual firms. Indeed, many exclude the small firm from the sample population and hence from the analysis (Hale and Cragg, 1996). A small proportion of the available literature specifically encompassed small business, and of this small amount, even less is written explicitly for the small firm. Francis and MacIntosh (1997) suggested the lack of literature on this topic might be because SMEs are less likely publicly to report their BPR efforts, though more significantly, it might be that SME managers considered BPR as not relevant to them. Most small enterprises, by definition, do not have the resources or the people to create rigid, hierarchical enterprises based around distinct functions; they tend to exhibit more informal communication and a less bureaucratic mode of operation (Francis and MacIntosh, 1997).

The organisational structure in SMEs is typically informal, but highly centralised, which provides strength in decision-making and rapid implementation of decisions (Blili & Raymond, 1993; cited by Hale and Cragg, 1996). This enables a more rapid implementation of change in the organisation. Further research has confirmed that small businesses differ from large organisations in other matters such as maturity and environmental uncertainty (Raymond, 1992; cited by Hale and Cragg, 1996). However, as they grow and develop, they do tend to migrate towards the traditional functional model, often to their detriment (Miller, 1990; cited in Francis and MacIntosh, 1997).

A need to identify stages of growth in SMEs has emerged from a lack of other supporting work and Galliers and Sutherland (1991) have referred to an alternative model.

This is the 7s model and takes an analysis from seven elements, with a view to giving a holistic understanding of the organisation. The 7s's are:-

- Strategy
- Structure
- Systems
- Skill
- Staff
- Style
- Superordinate goals

Galliers and Sutherland (1991) identify a relationship between organisational culture and management style. which is produced by a model from Slevin and Covin (1990). The Slevin and Covin model is also used to analysis style and structure in relationship to one another. Although this model was seen by Galliers and Sutherland (1989, 1991) as useful it is still considered restrictive so the research team have extended it to include the 7s model of Pascale and Athos which incorporates Hofstede's (1991) work for a broader understanding of organisational issues.

Hence, for Hale and Cragg (1996) these factors indicate that a different set of considerations may be important for BPR in SMEs). There is a need to investigate the small firm arena in order to determine whether the same principles for BPC in large organisations described previously also apply to SMEs, or whether a different approach needs to be taken by SMEs looking for change. Hale and Cragg (1996) attempted to provide some initial indication of the extendibility of existing principles and methodologies in the BPR literature to the small firm, they suggested it was possible that the characteristics of a small firm are such that a customised approach to BPR is necessary. Hence this review will finally assess the relevance of the various BPC methodologies to SMEs, and determine whether the issues connected with process modelling previously also were applicable to this environment.

Guidelines for BPC in SMEs

Barrier (1994) defined the simple meaning of BPR as putting the business through radical change and claimed that it was also applicable to small business (cited by Hale and Cragg, 1996). As larger businesses reengineer and become flexible enough to enter smaller markets, small companies may find that their niche becomes increasingly vulnerable, and need to become equally as effective as the reengineered large organisations. Barrier (1994) also suggests that SMEs may not find reengineering as far reaching and traumatic as large organisations because the bureaucracy and inefficiency is less ingrained, and outlined the following guidelines for SMEs considering reengineering:-

- Look at the company itself and how it is operated.
- Look at the market for impeding threats and also at competitors. Consider how the business could change the basis of competition and protect its niche.
- Don't focus on cost reduction alone, as capability can suffer. Focus on the customer instead and how the processes can be organised to best serve the customer.
- Use the small size of the company as an asset. Smaller organisations can change more quickly on a smaller scale.

These guidelines, whilst explicitly targeted at SMEs, are very general in their recommendations and do not offer assistance to the same depth as that available to the larger organisation. Furthermore, they suggest that there had been no kind of empirical basis or subsequent verification of the usefulness of these principles, and no superior methodology has yet emerged. (Hale and Cragg, 1996). Hammer and Champy (1994) also provide only recommendations on implementing BPR specifically for the small business. They claim that any company can adhere to principles of reengineering regardless of size, and a small firm merely needs to ensure that they do not fall into the same traps as larger companies as they expand. It would therefore appear to be more beneficial to empirically determine the applicability of existing principles and methods for implementation to the small firm, before "reinventing the wheel" by developing new principles for the small organisation (Hale and Cragg, 1996).

Most reengineering efforts are triggered by a crisis situation (Davidson, 1993; cited by Hale and Cragg, 1996) or firms needing radical improvements to stay in the business. Companies less concerned about the health of major processes are less likely to want to undertake the major upheaval caused by reengineering. According to Hale and Cragg (1996), the implication in the literature is that an SME will not encounter such crisis situations, and therefore have less need to reengineer their processes. They disagreed with Hammer and Champy's (1994) assumption that applying the same principles to SMEs as they grow and their structure and use of IT becomes inefficient, would prevent any need for redesign of their processes at any stage. This is on the basis that there is no evidence that the same principles are applicable to small and large organisations, or whether the principles themselves are infallible. In addition, it would be necessary for a small firm to have the requisite knowledge to follow these principles as their business expands, which will not always be the case. Thus, the literature tends to dismiss possible significance of radical approaches to BPC, such as BPR, for the small firm, although there appears to be a number of success factors which could be extended to the small firm environment (Hale and Cragg, 1996).

Model for business process change in SMEs

The most effective way to investigate the relevance of radical approaches to BPC such as BPR to SMEs would have been to analyse a number of smaller company BPR programme implementations. However, examples of such implementations were not available. As a result, many SMEs might not be aware of BPR and the researcher would have to introduce BPR and obtain useful views on its relevance. McSwinney (1995) considered this approach impractical. One alternative approach would have been to create models of existing small or medium sized manufacturing enterprises and to carry out virtual implementations on the models, though the weakness of this was that it would at best indicate the relevance of the concept of process redesign. McSwinney (1995) thought this would give no indication of the SMEs willingness to undertake BPR or its ability to carry out process redesign and implement the outcome.

McSwinney (1995) decided to improvise and examined a number of implementations in SMEs of a more incremental technique for business process change, World Class Manufacturing (WCM). Hence, the basic assumption was that an examination of WCM implementation would give valid insight into viability of a potential BPR exercise. The general relevance of generic business process change to SMEs was investigated, rather than focusing on one specific approach. McSwinney (1995) then assessed the level of support for the two positive hypotheses regarding the effects of business process change on SMEs and the seven negative hypotheses listed in Table 1.

POSITIVE -	Level of support
1. Continued survival or growth of an SME may depend on re-engineering style radical change and performance improvement.	Supported
2. SMEs are capable of implementing fast change and therefore the risk normally associated with a re-engineering programme may be reduced.	Weakly Supported
NEGATIVE -	
3. Because of simple structure SMEs will not need a 'full blown' BPR programme to exploit lucrative opportunities for restructuring,	Weakly opposed
4. Managers of SMEs may not be open to formal improvement programmes	Weakly opposed,
5. Managers of SMEs may not be open to idea of employee empowerment (essential element of most BPR solutions.),	Inconclusive
6. SMEs may lack the internal expertise to take advantage of BPR style information technology solutions,	Strongly supported
7. SME may not be able to dedicate sufficient internal resources to achieve successful implementation of a BPR programme.	Supported
8. Challenges facing SMEs may reside mostly in the finance and marketing arenas and therefore may not warrant a business process focus.	Strongly opposed
9. It is likely, particularly in the area of product development, that an SMEs process will reside partially outside the organisation. This may have a detrimental impact on the SMEs ability to reengineer such processes.	Weakly supported

Table 1: Results of survey on effects of BPR in SMEs from McSwinney (1995)

Hale and Cragg (1996), specifically focused on the BPR methodology employed by one firm and compared this to the following steps outlined by Davenport & Short (1990), as it was not possible to include all potential factors in the investigation:-

- Identification of critical processes within the small firm, as compared with the success of their BPR projects and Hall et al's (1993) measures of breadth and depth.
- Use of IT as a lever for BPR and the role played by IT in the project as a whole.
- Identification of a vision and objectives for the reengineering project, and the degree of planning for BPR conducted. The existence of executive commitment and organisational involvement, the initial motivation for reengineering, and the treatment of those directly affected by any major changes.

Hale and Cragg (1996) investigated the applicability of these BPR steps and principles to SME through presenting a case study of an SME that claimed to have experience with BPR conducted via semi-structured interviews with the managing director and two other managers. The aim of this was to identify similarities and differences between the BPR approach of the SME and the approach advocated for larger firms, as identified in the literature. The Hale and Cragg (1996) study followed a modified approach to the development of a model of planning for BPR proposed by Grover, Teng & Fiedler (1993). This approach was selected as it was regarded it as one of the few methodologically sound papers in the BPR literature, and one that has been independently validated. The case study approach was also considered an acceptable form of research for such exploratory work, based on Eisenhardt (1989).

Findings of research into BPC in SMEs

Role of IT in BPR

McSwinney's (1995) survey in Table 1 indicated that management in the SMEs surveyed knew that there was a need to undertake business process change. However, they thought radical change such as BPR had the potential to be a risky venture, partly due to a lack of technical expertise within SMEs. Based on these results, the hypotheses were reformulated in Table 1 to review the relevance of BPR to SMEs as indicated in Table 2. This suggested that radical approaches to BPC such as BPR are possible in SMEs without IT, although McSwinney (1995) did recognise, along with the other commentators mentioned earlier, that IT could be a powerful enabler of the change process. This view was supported in separate research conducted by Gadd (1994) and Ahmed and Simintiras (1996) who suggested IT was not essential for BPR and was simply one of many, rather than a critical enabler of change. Indeed, according to Francis and MacIntosh (1997), debates have emerged in the literature on role and importance of IT in BPR, the conceptualising of business processes, and the scale and timing of BPR applications. They suggested that IT either played a central, underpinning role, or there were other situations where the benefits of BPR can be attained without use of IT. In addition, IT planning in SMEs was largely determined by their management style and organisational structure rather than by the conventional theories (Doukidis, Lybereas and Galliers, 1996). This meant that IT issues might be different within SMEs and accordingly BPC might require a different approach given the previously identified close relationship between BPR and IT.

1.	The SME is faced with a situation where survival or growth depends on radical performance improvement of a radical change in the way business is carried out.
2.	The SME commits in advance to dedication of sufficient internal resources to the BPR effort. This is not simply an allocation of personnel. Some of the existing duties of the personnel must be reassigned for the duration of the project.
3.	SMEs must be in control of the major portion of business processes or interest, or they must have the co-operation of other organisations involved.
4.	The BPR effort is facilitated by external BPR experts.
5.	IT is viewed strictly as a means and not an end. It may potentially be a very powerful enabler, but equally powerful non-IT related BPR solutions may exist.
6.	The external BPR experts are able to provide appropriate support for IT solution, design, implementation and maintenance. The maintenance may be contracted elsewhere, but is an essential aspect of a viable IT solution.
7.	The implementation pays particular attention to the difficulty of changing inappropriate management styles. Training may not be enough. Visits to other organisations and pilot exercises may be required. Some managers with the SMEs may not make the transition.

Table 2: Relevance of business process change to SMEs from McSwinney (1995)

Alternatively, there is a possible risk to this conclusion. For example, if IT was not considered a key element of BPR, what would happen if the IT system did not match the redesigned business process? Hence, an SME's legacy systems could be a potential risk factor to their Business process change process. Further support for this was found in Davenport and Short (1990) who thought that IT could be more than a useful tool in Business Process redesign, since IT and BPR had a recursive relationship. Teng and Kettinger (1995) suggested a lack of IT hindered BPR. Indeed, IT professionals could provide significant assistance to ease any dramatic effects of BPR (Teng and Kettinger, 1995).

Similarities with large organisations

Hale and Cragg (1996) found a number of similarities in regarded to the literature reported for large organisations:-

- Companywide vision with strategy,
- Significant role of IT as a lever for reengineering
- Management commitment - give employees required tools to facilitate changes.

However, they also found a number of differences in SMEs:-

- No development of process objectives during planning for BPR.
- Management looked at the mission plan and formulated plan from that, though this did not appear to have a significant effect on the success of the project.
- As the whole business is affected, the long-term plan may have been adequate as the next step was definition of essential or value adding tasks and the allocation of these to each employee.
- There is no initial definition stage, where processes as they existed at the time were analysed, documented and measured before going ahead with the planned reengineering. It is impossible to determine effects of project without this stage as not know situation prior to BPR.

Hale and Cragg (1996) therefore suggested that there were many similarities as well as differences between the approach of SMEs to BPR, when compared with large organisations. The many similarities suggested that much of what was advocated in the BPR literature for large organisations was applicable to small firms, though it was not possible to generalise conclusions for all SMEs without further investigation. In addition, a lack of certain factors did not have a serious effect on the project. They suggest that the isolation of factors which appear to be inessential for small firms and underlying reasons for those differences would be beneficial in developing a customised methodology for any firm wishing to successfully attempts reengineering.

Doukidis et al (1996) provided further support for the argument that research undertaken within large organisations is not necessarily applicable to small companies. They considered the environmental issues that relate a SMEs to the larger community and following that line, state that there is a need for context related research in SME business. Organisational characteristics are also seen as being substantially different in the SME environment. The entrepreneurial business is identified by a series of characteristics as tabulated by Kets de Vries (1980). This includes the 'top manager' role who in the vast majority of SMEs is an innovative source of information and initiator of decisions. Strategy is described as intuitive rather than analytical, as it is performed by people who feel for their business.

The key here is that small businesses that can manage their information needs have the leading edge. This bold statement is supported by the work of Forest and DeCarlo (1984), who also see three major differences between SMEs and larger organisations:-

- that SMEs use computers as tools and less as a communication medium;
- that SMEs have fewer stakeholders and therefore are likely to have fewer problems in terms of organisational politics;
- that SMEs have fewer resources to implement IT solutions.

Further investigation of BPC in SMEs required

Thus, there was some confusion over BPR in SMEs and the associated risks and methods. Hale and Cragg (1996) identified the need for further research on BPR in small firms, including the development of a methodology specifically for small businesses. This was on the basis that initial conclusions from their examination of the application of BPR in one SME provided an initial indication of the possibility and necessity of developing a methodology specifically for SMEs. They suggested that this was considerably different to the recommendations for large organisations where strategic alignment is an essential step for BPR. The fact that the whole organisation went through the change, along with management commitment, also contributed to the success of the project.

In particular, Hale and Cragg (1996) mention how Davenport and Short (1990) suggested that the process structure was the most efficient after reengineering. However, this was also stated as too volatile for a large organisation. Given the more informal organisational structure in SMEs, they considered that a process structure could be most suitable and an effective option for an SME. The SME examined by Hale and Cragg (1996) had already shown some tendency towards this kind of organisation. The team approach was excellent for process structure, as the organisation of teams was similar to organisation of processes. If a team was responsible for one process, then any changes could be kept within that team, thus minimising disruption (Hale and Cragg, 1996). It is therefore our suggestion that the relationship between IT and BPR within the context of small organisations requires further examination to establish the relevance of BPR to SMEs and a possible of risk of IT to change within SMEs.

In conclusion, the BPR literature acknowledges a need for process focused change within the organisational context. The focus of the thesis is on the situated context of the SME considering change. Due to the lack of in-house expertise within SMEs a need is identified for a means to adopt appropriate methods to understand the organisations processes prior to re-modelling. This thesis will endeavour to provide such guidance.

Concluding remarks

This chapter has reviewed literature in relation to the key aspects of this thesis. Firstly literature has related to the domain of a critical approach to information systems. This presents the underlying paradigm under which this thesis is situated. The critical approach impacts upon the manner in which the research is conducted, the role of the researcher, the methods available for investigation and is of primary concern from these perspectives. The second body of knowledge investigated in support of this thesis was concerned with the manner in which business process models are developed and constructed. The problem domain of small organisations has a unique set of needs in relation to how they 'do the business' the literature was gathered and appraised in relation to this set of user requirements, such requirements having been gathered from the first phase of the research process. The final body of research reviewed concerned the state of knowledge surrounding small to medium sized enterprises and the issues surrounding information system or process change, which was the primary topic of the RAMESES project. This literature was utilised in support of the first hand understanding of the SMEs, the issues that surround change and informed the development of the simplified method described in full in chapter 6.

CHAPTER 3

Conceptualising SME research through socio-technical systems approach

Introduction

This chapter outlines the research context being the RAMESES project, and summarises the case material as the context for the thesis development. The next section considers the business process modelling requirements within such an environment and introduces the outline method developed within the RAMESES framework, (see appendix 1). Finally the needs and characteristics of the user in small organisations are considered. This work is set within a theoretical socio-technical systems framework, as a means by which organisational complexity may be redressed with the application of an appropriate modelling technique.

The context of the research project

The issues reported in this thesis have been identified as a result of detailed case study analysis of six small organisations in the North-east of England as outlined in chapter 1. The project has adopted a wide definition of legacy systems in that legacy systems are considered to be "existing systems components that will impact upon potential changes".

The research issue for this thesis was founded within the RAMESES project, but is specifically concerned with the necessity for SMEs to undertake the activity of business process modelling. The need to understand the 'as is' position of an organisation is fundamental to the development change or implementation of any information or communication technologies (ICT). The primary research question was 'are SMEs able to model business processes in such a way that will enable the effective analysis of the organisation in order to support information systems development change or implementation'. The objective of the research was to develop a method by which this business process modelling activity could be supported in a fashion which was accessible and effective within the target environment.

The context of the case study organisations

The research was carried out in three phases, each with their own case studies. The fieldwork was conducted at five manufacturing organisations and at one organisation in the retail and distribution sector in the North East of England. Four of the manufacturing companies are described as "job shop" in that its manufacturing activity revolves around made-to-order, low volume, high value products. Companies in this sector tend to encounter problems as soon as they attempt to procure, and use, standard off-the-shelf packages that are aimed at the manufacturing industry. The main reason being that in such packages manufacturing is viewed as a batch environment, producing high volume, low cost products.

Company	No. Employees	Business
A	50	Commercial Drive products
B	70	Component pre-fabricater for defence industry
C	80	Global retail distribution
D	100	Component and service provider for defence industry
E	90	Commercial Filtration products
F	180	Computer component manufacturer

Table 1: Company profiles

The detailed IT audit that was carried out in each company established that the structure of their socio-technical legacy system consisted of a number of loosely coupled components which ranged from off-the-shelf packages to bespoke systems. Typical examples of these components are a Manufacturing Requirements Planning (MRPII) system, accounts software and office support software that combine to create company specific applications.

Company	Reason for change	Company type	Change requirement Driven	Implemented by	Predominant business need
A	Being bought into larger consortium	reactive	internally	external	survival
B	Relocation for consolidation of companies	active	externally	external	opportunity
C	Undertaken BPR	proactive	internally	Internal	efficiency
D	Change of management structure	proactive	internally	internal	stability
E	Total quality management initiative	proactive	internally	external	efficacy
F	Failed ERP implementation	proactive	internally	external	recovery

Table 2: Company change profile

The senior management at each of these organisations had recognised that their legacy system was ineffective in support of their business requirements. This analysis was precipitated in each case, not by a review of their software (for quality or suitability), but by a management initiated business change. The reasons for these initiatives were varied and are summarised in table 2.

None of these organisations had set out with the purpose of reviewing their IT systems. However, as they began their business process changes, it quickly became obvious to them that what they wished to do was, in certain instances, impeded by their use of software. For instance, during Company C's business process reengineering the company had realigned its activities and personnel to match the identified core business processes. When the fieldwork began they had identified a mismatch between their unaltered software systems and their now processually defined structure: which was seen as an impediment to their business efficiency.

Categorisation of the organisational systems

The range of areas researched within the field of software engineering ranges from requirements engineering to software maintenance, but has typically focused on the problems associated with large-scale systems and the software engineers who undertake such work, for example, Grundy (1999) and Niessink & van Vliet (1992). The IT system typically present within this type of organisation consists of a number of loosely coupled components which are typically commercial-off-the shelf packages (COTS). This system profile requires a different approach to engineering than that required by corporate large-scale systems. Component-based software engineering (CBSE) offers the closest comparison to the types of systems existing within these organisations and the focus for the management issues that arise.

COTS-based systems and their maintenance

Within the context of this research is a focus on the definition of system components to reflect the needs and issues raised within the small organisation. For the purpose of this research the definition of system component is as follows:

> "A system component is a unit of composition that is a replaceable part of a system. The component is defined by its explicit context related to the implementation of a business requirement. The system component within the small organisation may be any artefact that contributes to fulfilling the business need. An artefact for such an organisation may include hardware, software communications technologies or training and implementation for staff".

For systems built from such parts the focus of the systems manager exists at the extreme points of the software life cycle: requirements engineering (being essential for the acquisition of component-based systems), and maintenance activities (to ensure continued compatibility between system and business). A system comprised of such components differs in character from typical large-scale systems (Arthur, 1998) although, for both, the traditional issues of maintenance still apply. In the CBS context, however, the maintenance viewpoint moves from considering just technical issues to contextualising the impact of such systems: returning the focus to the fit between the system components and the critical business processes (Ludwig et al, 1998). We have seen that the issues for most small organisations are, therefore, of component deployment, implementation and maintaining 'fitness for purpose'. This perspective of CBS maintenance exists within a dynamic organisational environment where system components are under constant pressure to fulfil changing business needs. This requires an iterative approach to system requirements capture, where adaptation may predominate as the maintenance activity.

Component-Based systems in the case studies

The first phase of this research was conducted at two manufacturing organisations and at one organisation in the retail and distribution sector in the Northeast of England. The detailed IT audit that was carried out in each company established that the structure of their socio-technical (Mumford & Beckman, 1994) legacy system consisted of a number of loosely coupled components which ranged from off-the-shelf packages to bespoke systems (Braun & Mohle, 1998). Typical examples of these components are a Manufacturing Requirements Planning (MRPII) system, accounts software and office support software that combine to create company specific applications. The senior management at each of these organisations had recognised that their IT system was not effectively supporting their business requirements. This analysis was precipitated in each case, not by a review of their software (for quality or suitability), but by a management initiated business change.

Component-Based maintenance in the organisations

The data collected from the organisations studied yielded a number of issues that illustrated aspects of maintenance needs. It has been identified within the research that the type of component within the system dictates to some extent the maintenance approach required, to which end four primary acquisition strategies within the organisations that have an impact have been identified (Edwards & Mallalieu, 1999). These are:

- In-house professional software development
- Third party bespoke development
- Specific COTS packages
- General COTS packages

Loosely coupled IT systems comprised of these types of components, have a number of potential benefits for small organisations. For instance, a company knows that the functionality of the individual components can be adapted to meet changing business requirements. When problems occur, the company may upgrade or change the relevant component rather than an entire system (Pfleeger, 1998). User skills can be externally sourced to fulfil immediate or long-term goals. These factors are important given the need for small organisations to remain flexible to their changing environment despite their budgetary constraints (Brown & Wallnau, 1998).

The context of the business processes

For many years systems developers have talked in terms of "greenfield sites" and have produced methods to use in such a context, these cover different phases of the software development life cycle: for instance CCTA, (1996) and Coad and Yourdon, (1991). The implicit assumption is that software development primarily takes place in virgin territory. However, as practitioners and researchers alike know, this is not a reflection of reality. The software engineering landscape is often composed of "brownfields": that is those sites that need to account for the existing organisational context, its software systems and business practices (Edwards and Mallalieu, 1999). An important and recent focus in the software engineering community has been in the recognition that, not only do systems have to fit into the existing (organisational) landscape, but that that landscape itself changes both independently of, and in response to, IT systems. The terms "co-design" or "co-evolution" have been coined to encompass this concept (Edwards et al, 1999). Once systems development moves away from greenfield sites, the task of planning and implementing change can become substantially more complex. A main aspect of the work reported here has been in devising appropriate techniques for capturing, representing and understanding the business activities within individual SMEs and the relationship between these and their IT systems and their users. This is of practical importance to managers in SMEs since, for instance, when a new system is needed to support a particular business activity, the interconnections between many of the existing systems and business processes can act as a constraint on the range of solutions available to the organisation.

Understanding the impact of existing and planned systems in any organisation is complex, therefore those involved in both the analysis of business processes and requirements specification of systems need a range of appropriate tools to support them in their work. The empirical research in the SME environment, focused on the manufacturing and distribution sectors and has shown them to have the following typical characteristics with respect to IT systems:

- Their IT systems are business critical.
- They perceive IT systems as tools to support business activities
- They rarely have IT departments.
- They rely on informal acquisition of IT knowledge.

Therefore, for such organisations, IT systems specification, acquisition and evaluation is both important and difficult. The research has shown that for current IT systems usage and future IT systems requirements can be most effectively understood when viewed from a business process perspective. This section presents the business process modelling technique that has been developed and trialled within the research organisations. There are many process modelling techniques available (Ould, 1995; Giaglis, 2001) two of the most popular approaches are data flow diagramming (Yourdon, 1989) and IDEF (for Integrated Definition) (McGowan and Bohner, 1993). However, the terminology and complexity of usage associated with them makes them inaccessible to the majority of SME personnel. Some simple techniques, based upon data flow diagramming have been proposed and used successfully within a business process context, for instance Deeks et al, (1997), and Tam et al, (2001). however, these do not support the richness of data that was required given a focus on systems change. The Business Activity Modelling (BAM) technique, developed during this research, requires little in the way of training, is easily understood by SME personnel and has the benefit of explicitly identifying the areas in which IT systems and business activity are interrelated (Tenant, 2002).

The context of the users

Within the research a number of existing process modelling techniques were trialled (for instance, DFDs, IDEF, RAD) since the research team were keen not to "reinvent the wheel". However, it was apparent that none of these effectively captured the range of data that was required. Therefore, the requirements of the end-users (the SME staff) and the research team were examined to determine an effective modelling approach. These requirements can be analysed under three headings: Acquisition of the Business Process, presentation of the business process and analysis of the business process. Once these requirements were clearly understood the modelling technique itself was developed.

The requirements for the technique

The technique, "Business Activity Modelling (BAM)" has evolved in response to three main requirements in an SME environment: acquisition, presentation and analysis of the business process.

Acquisition of the business process

The main requirements in determining the type of process modelling that was required were the need to:

- model the managers' perception of the business activity at a macro level,
- determine in detail the specific tasks undertaken within each business activity (micro level).

- map onto the business processes the tasks that are supported by IT systems and which software elements are present.
- provide an approach that is accessible to all levels of employees within SMEs

In addition to these requirements there were constraints imposed by the SME environment itself:

- Managers in SMEs may be unwilling to invest time in training personnel to use conventional process modelling techniques since the old adage "time is money" is foremost in their minds. Therefore, any process modelling technique that needs to be used throughout an SME (rather than by a few specialists) needs to be readily accessible with the minimum of training and support.
- All employees hold a combination of tacit and explicit knowledge about their job. They are aware of what they need to receive to carry out their allotted tasks and what they do with the result upon completion.
- In practice staff in SMEs readily know the (i) "reporting-to" and "responsibility for" structures and (ii) individual task inputs and outputs.
- Staff are also aware (to some extent) of their role in relation to the overall business process and know explicitly the software they use in support of their tasks.

These requirements and constraints held the key to the development of an appropriate modelling technique.

Presentation of the business process

Even simple diagrams become cluttered when they are used to demonstrate the business activities within an organisation. There are two main features that can be used to overcome this problem: hierarchies and layers.

- Hierarchies: This is an approach traditionally used in process modelling. The provision of a hierarchy within the modelling approach allows the user to both look at an overview of a business process (to gain an understanding of its overall topology) and then to focus on individual elements (to drill down to their pertinent details).
- Layers: These are akin to the layers used in geographical mapping, where basic maps can have features added, or removed, dependent on the requirements of the viewer (for instance, contours, roads, places of interest). In the case of the process maps in RAMESES these layers refer to system usage, and staff skill, for instance.

Conclusion

This chapter has identified a theoretical framework in which this thesis is situated. The socio-technical systems approach offers a mechanism by which the complexity of organisations can be unravelled. Within the research undertaken the sociotechnical systems was aligned with the key issues under investigation, so that the social perspective related to the needs and issues related to the users of the system. The technical perspective related to the facts and interrelatedness of the information systems in use. The systems perspective was taken as an organisational managerial perspective which approach the identification of the structural aspects of the organisation and how that impacted upon the information system as the organisation. The Business Activities Mapping technique which was developed is an attempt to gain an accessible knowledge to support the understanding of the organisations 'as is' position. The knowledge gained by the adoption of this framework will be further reflected upon in the evaluation section of this thesis and related to the research process itself.

CHAPTER 4

The research approach

Introduction

Working with 'real-world' problems is at the centre of the RAMESES research project which focuses on Small - Medium Enterprises (SMEs). In designing the study care had to be taken to ensure the relevance of the research techniques to be used. This chapter outlines the benefits of using a combination of qualitative and quantitative research methods within the bounds of a multi-disciplinary research team to enable effective exploration and investigation. The concept of the research life-cycle has developed the notion of appropriateness in method and approach: this is discussed against the values of the critical and realist paradigms.

In Chapter 2 the research traditions of IS and critical theory were introduced alongside the research literature relating to process modelling and small organisations. These issues were set within a framework of relevance through the foresight programme where small to medium sized enterprises are seen as being fundamental to economic development. Chapter 3 related the thesis to a 'socio-technical' systems view of the domain and offered the framework under which the investigations were carried out.

This chapter provides a discussion of the choice of research approaches and activities and the justification of such choices. Such a justification of methods aims to elucidate the appropriateness of the methods chosen and identify the rigour through which the research was conducted. Practical aspects of the research activity are presented in Chapters 5, 6 and 7 which when combined with this section provide a reflexive appraisal of both the research process and the author's contribution (Jayaratna, 1994).

This chapter begins with a discussion of the need to identify a research approach and the various factors which affect the choice for this project. Each of these factors is then discussed in turn to identify the underlying research epistemology of the author, the type of data required to illuminate the chosen research area within the context of the framework for the work, and the possible research methods which could be utilised from within the IS field. The chosen research approach is described and supported with the choices of methods for the different phases of the research.

Factors affecting the choice of research approach

The research approach is more than just method, it is an identification of the philosophy underpinning the work and reflects the 'spirit' of the research. Research is very much a matter of personal style and, it is important to address the range of choices available in IS and not just to adopt the particular approach of the researcher's host institution (Galliers, 1991). Options include the research methods in use within the IS field, the underlying epistemology of the researcher and aims of the work, as well as the types of data which will provide the richest learning about the research issue within the theoretical framework of the research. Both the author and the reader need to be convinced of the appropriateness of the research approach and that it builds on the cumulative tradition within the IS field. The rigour and the relevance of the research may be determined within this process of choice-making, which will affect the results of the research and, subsequently, their credibility to the target audiences (Keen, 1991, Trauth & O'Connor, 1991).

Within this chapter, these options are discussed in the context of the project but it is emphasised that the categorisations used necessarily establish artificial boundaries, attempting to describe ideal types rather than the complexity, and messiness, of reality. This discussion acknowledges the usefulness of such categorisations, in that they enable the author to reflect on the context of the research and present her thinking to the reader in order to establish some common understanding of the choice-making process.

The choice of research approach should consider all aspects of the research situation which may have an affect. Checkland's (1991) framework of factors was adapted to incorporate the underlying epistemology of the researcher and the effect of identifying the target audiences in advance of the project. The resulting factors which were to be considered were as follows:

- the researcher
- the research issue
- the theoretical framework supporting the research
- the target audiences for the results
- the research methods available in IS

The research approach needs to reflect the researcher's epistemology and personal style, providing a comfortable vehicle for their skills and aims in carrying out the research in order to effectively address the research issue. The researcher should both enjoy the research activity and be able to maximise their learning and understanding of the process. The chosen approach must provide the richest form of data for learning about the research issue and the supporting intellectual framework, employing the methods or techniques available within the field. The research methods in IS can be used flexibly within the underlying philosophy of the research in a manner that is compatible with the research strengths of the researcher (Keen, 1991).

Although IS developers are encouraged in the IS literature to become 'reflective practitioners' (Schon, 1987) the differences between research and practice need to be considered, particularly with regard to choice of methodology and evaluation. There is some useful literature in the area of choice, considering the role of the analyst, the philosophical underpinnings of development methodologies and the use of multiple perspectives in projects, but the ability of the individual IS practitioner to 'choose' within the context of organisational projects is not usually addressed (Avison & Wood-Harper, 1990, Flood & Jackson, 1991, Mitroff and Linstone, 1993, Walsham, 1993). Analysts and project leaders may engage in choices regarding the detail of projects, such as those identified in the work of Mason and Mitroff (1973), but the more fundamental choices such as issues of development methodology and philosophy are often dictated by the organisation and its historical context discussed in Orlikowski's (1993) study of CASE tool introduction. The area is rich in material for IS research on the issues involved in the use of methodologies.

In the sections that follow, each of the five factors, identified above, which influence the choice of research approach are discussed in detail for this particular research. The reader is referred back to Chapters 2 and 3 for more detail of the supporting literature, the research issue and the theoretical framework, all of which will be summarised briefly in this chapter.

The researcher

The choice of approach for a particular piece of research will be affected by the underlying epistemology of the researcher. Their assumptions about knowledge and how to 'learn' about the world and the way it operates will identify what, to them, constitutes 'valid' research (Hirschheim & Klein, 1992, Myers, 1997).

Possible research philosophies

Three broad philosophies of research approaches are generally discussed in the IS literature, namely positivist, interpretivist and critical (Jonsson, 1991, Orlikowski & Baroudi, 1991, Wood-Harper, 1992, Myers, 1997, Klein & Myers, 1999). The distinctions between the three are not always clear cut, and it is possible to accommodate several approaches within a single study. It may be possible to adapt the research methods used in IS within each of these categories, although Flood and Jackson's (1991) work on IS development methodologies should lead us to be aware of the dominant philosophy underlying a particular method and its impact on the research process.

The positivist approach has its roots in the natural sciences and is based on the assumption that the phenomenon under study is identifiable and tangible, and that stable and uni-directional cause-effect relationships exist within the world, which can be identified and tested. The researcher assumes the role of neutral observer, avoiding any influence on the subject under study, providing factual, empirical observations. The core objective of the detached researcher is to discover universal laws or principles, with the purpose of predicting future behaviours. Research methods include hypothesis testing and using representative samples of given populations to draw inferences about the phenomenon. The positivist approach assumes the notion of freedom from researcher bias and prejudice, that the inquiry is value and context-free. Where this approach is utilised in investigating human behaviour, it assumes such behaviour to be rational, intentional and guided by some maximising objective. (Jonsson, 1991, Orlikowski & Baroudi, 1991, Wood-Harper, 1992, Klein & Myers, 1999).

Critics of this approach, such as Hans Gadamer, assert that researcher prejudice is a necessary component of understanding, and that recognising and reflecting on that prejudice in terms of the historical context of the research enables the researcher to deal with the practical problems of interpretation of their findings (Gadamer, 1976, Heckman, 1986). The applicability of the approach should consider its appropriateness to the study of human activities, where the phenomenon may be complex and not clearly divisible into component parts, and where the researcher's interaction with the situation may also impact on the subjects of the study.

The interpretivist philosophy, in contrast, assumes that reality is produced, and reproduced, by human beings through their behaviours and interactions with others. People perceive the world and act on their subjective interpretations of that perception. The interpretive researcher aims to access reality through social constructions such as the language and shared meanings of those engaged in the situation under study, attempting to understand the phenomenon through the meanings that actors assign to it. The focus is on the complexity of the situation as it emerges, looking to understand the context and how it influences the phenomenon, rather than the investigation of pre-determined variables. The approach has a hermeneutic and phenomenological basis where the researcher's learning is cyclical and takes place throughout the research process. (Boland (1987, 1991), Jonsson (1991), Orlikowski & Baroudi (1991), Wood-Harper (1992), Walsham (1993b), Kaplan & Maxwell (1994), Klein & Myers (1999).

The experience and skills of the researcher are emphasised within this approach, in particular their ability to identify personal biases and assumptions throughout the research process (Beer, 1990), (Galliers, 1991). The researcher uses their preconceptions in order to guide the investigation, interact with the human subjects of the inquiry, and thereby alters perceptions of both parties, as well as interpreting their findings based on their personal perceptions of the data they collect (Walsham, 1995). The findings are acknowledged as being value-loaded, rather than the value-free assumptions in positivist thinking, reflecting the researcher's own position. This is a fundamental aspect of interpretivist work, a factor to be understood and incorporated into the research itself, not a limitation to be overcome (Suchman, 1995).

Many argue in the literature that there should be more interpretivist research in IS, stating that it is better suited to the area than is positivist research which has dominated the field (Orlikowski (1991) Jonsson (1991), Wood-Harper (1992), Wastell (1993), Walsham (1995). IS research is becoming more accepting of the need to adopt techniques that consider the historical and contextual aspects of IS, which could be beneficial in opening up the dialogue and understanding between IS researchers and practitioners.

Within critical thinking, the third classification of underlying research epistemologies, a criticism of the interpretive approach is its tendency to harmonise the world. The critical approach views reality in terms of its historical influences and the affects of power relationships. Such research aims to provide a social critique, exposing restricting and alienating conditions in a particular situation through a focus on opposites, conflicts and contradictions. It seeks to be emancipatory by raising awareness of restrictive influences and the social, cultural and political domination that constrains people's ability to change. The assumption is that people can consciously act to change their social conditions and realise their potential. (Alvesson & Wilmott (1992), Hirschheim & Klein (1994), Klein & Myers (1999).

The critical researcher is required to reflect on the presuppositions that enter into the search for knowledge, making transparent to themselves, and their readers, the normative content of their research designs and subjecting their work to critical inspection. Critical research recognises that the research process itself is subject to ethical, political, metaphysical and ideological influences, and needs to be read within the societal and organisational, climate in which it is carried out. The research methods used within a critical approach should be selected with an awareness of their social consequences, seeking to maximise the potential of all those involved.

Some of the thinking behind the categorisation of research epistemologies has been reflected in the IS literature with respect to the use of methodologies in IS development. Early work by Mason and Mitroff (1973) identified the need for reflection by developers to recognise the possible differences between themselves and their business users. Later work by Avison and Wood-Harper (1991) utilised the paradigmatic framework to consider the philosophical assumptions of the analyst (Burrell & Morgan (1979), Hirschheim & Klein (1989). Their paradigmatic view provided a frame of reference, or commonality of perspectives, which enabled the developers to plan and carry out their work. The emphasis taken was that the developers could choose the role to take, as was appropriate to the given organisational setting. In research terms, this emphasis is less concerned with the constraints imposed by the research environment and more on the researcher's personal epistemology.

Identifying the researcher's epistemology

The author came to this research with a rich experience in both education and employment (an overview of the author's background was provided in Chapter 1). The background factors which were most significant in forming her epistemological view were the understanding of businesses and the process of working through a number of organisational roles illuminated and reflected upon whilst studying social theory as a mature student.

At various career stages, the author had addressed paradigmatic conflicts in her thinking: in the 'messiness' of communication within the complex social situation of any organisation especially when dealing with colleagues of different social, cultural, disciplinary and gendered backgrounds; and, especially when training in organisations, the necessity to adapt approaches to the different cultures was essential to effective results. Such working experience led to the acknowledgement of a personal *weltanschauung* as being a strong commitment to respect for the individual and their capacity to learn and to contribute creatively to their environment.

Understanding that creative ideas for change already exist in any problem situation was learned through experience of problem situations. The perceived need was for these ideas to be elicited, co-ordinated and communicated to those with the power to direct or influence change, which may include the originators of the ideas themselves. Where these ideas were in conflict with the aims, or hierarchy, of the organisation there were often attempts to suppress them, usually resulting in a deterioration of the success of any development project and of the capabilities of the people involved to develop their own or the organisations potential. In a research environment, however, the possibility exists to investigate phenomena where conflicts exist and to expose assumptions and enable individuals to voice their opinions freely (if anonymously).

The researcher's epistemology, therefore, was considered to be critical. In order to produce a 'valid' piece of research, attempts have been made to make the choice-making as transparent as possible to the reader and to address the research with the aim of promoting awareness and debate of the research issue amongst those engaged within it. The essential elements from this critical approach for the research methods used were: to learn from the people in the situation; through open and honest discussion, and to question accepted realities.

One wary note concludes this section, which is about the difficulties of self-awareness and the delusions under which we mostly function.

The research issue

The choice of research approach needs to provide the richest possible data for learning about the research issue, which is: understanding the beliefs and behaviours of SMEs in relation to their business processes and information systems. In order to determine the type of data which could best inform the author about the research issue it was first necessary to identify the possibilities available. Data is usually classified within the literature as quantitative or qualitative, and any research project may utilise either or both within a variety of research methods and for a variety of purposes.

The use of quantitative data originated from the natural sciences and the study of natural phenomena. The data is derived through measurement and observation of pre-defined dependent and independent variables, and analysed through statistical techniques, providing summaries and indicators of statistical significance of results. Methods utilising such data may attempt to understand the 'purpose' behind the phenomenon through a study of its 'behaviour', or ignore such purpose altogether. In contrast, qualitative data comprises records of interviews, conversations or impressions of situations and is beneficial in investigating social and cultural phenomena (Lee (1991), Orlikoswki (1991), Myers (1997). In attempting to understand situations involving people and the social context in which they live or work, the researcher is advantaged in being able to ask for explanations or just to listen to actors describing the phenomena. Quantifying textual data may cause the researcher to lose the understanding evident in that rich data (Kaplan & Maxwell (1994).

In this project, the research issue was to understand how small organisations understood their business processes and which approaches would best suit their interests, beliefs and behaviours. The emphasis on 'understanding' and beliefs' implied that it was important that the author should engage in dialogue with the community members in some depth, which in turn suggested the likely predominance of qualitative data in the work. The author's experience of working practice and social theory led her to want to investigate the reasons people gave for their behaviours. When working, it can be clear that people often perform activities because of historical precedence or because of assumptions they hold (untested) about other peoples' needs or expectations of them. Many activities are influenced by group thinking and are due to the constraints of hierarchies and functional divisions within organisations. Business Process Reengineering attempted to directly address such behaviour and thinking (Hammer & Champy (1993). It was considered important for the author to gain access to the community and to gain an understanding of the social context of that community and such political issues that existed with respect to the hierarchy and power groupings. Beer (1990) was convinced of the need to bring together the views of stakeholders, and the importance of the identification of 'intentions' or 'ideals' of organisations rather than attempting the difficult task of describing the reality as it exists. A fundamental aspect of this research was focused however on how a description of reality as it exists could be elicited from the users in order to aid comprehension of the business process.

The second important aspect of the research issue was the need to have a view of the 'as is' position of the current systems supporting the organisations and their business. This was considered to be an essential pre-requisite to change. The aim here was to gather the quantifiable and 'hard' system data such as was available to aid the specification process.

The research framework

The theoretical framework for the organisations as information systems rather than information systems as a subset of the organisation are set out in chapter 3. Utilising the Multiview 2 Model, which incorporates the theory of Multiple Perspectives and Stakeholder Analysis, encouraged an holistic approach to the research which would encompass cultural, political and personal issues as well as the technical activities of business process modelling. The soft systems philosophy also underpinned the framework, with the author aiming to develop an understanding of the issues through engagement with the community, developing her findings through an analysis process and returning to the community to encourage discussion and self-reflection about the issues which might result in actions for change.

The influence of the framework reinforced the need for predominantly qualitative data, within either a critical or interpretive philosophy, supporting the epistemological view of the author

The target audience

The identification of a target audience affects the choice of research approach, it also is important in guaranteeing the relevance of the research and the researcher should have, in advance, a clear conception of the target audience they wish to influence (Keen (1991). Having identified the audience, the rigour of the research comes in selecting a research approach which aims to influence 'action' within that audience: through a pluralistic intellectual framework; the collection of evidence and the presentation of results in a persuasive manner suited to the audience. In other words, the work must have a 'purposive identity' in influencing action by a target audience.

For this project the author identified a number of different target audiences: those members of the academic community involved in the project; the academic community more generally; the author herself; and the SME practitioner audience. This broad range of audience implied that great care should be taken to make the research widely credible. This wide range of audiences forced the author to consider her work in terms, not just of its rigour and relevance, but also with respect to the credibility it needed to achieve to the community under investigation.

Firstly, there needed to be credible interactions with members of the SME community within the data collection activity and in dissemination. These people needed to be engaged in a dialogue about their situation and the author's interpretation of the findings. The process necessarily included learning both for the author and the other participants. The author's background experience in such organisation coupled with previous research in systems to aid co-operative working for users supported both the skills and initial knowledge required to achieve a credible dialogue. No claims that the researcher was 'representative' of practice were made, indeed the fact that she was engaged in academic research via the PhD process was evidence that she was not a typical practitioner, since the numbers who engage in such activity are very small. The academic role of the researcher had to be 'played down' as within the SME culture many of the interviewees are suspicious and sceptical of academic relevance. The previous organisational experience of the researcher was a key aspect of the ability to gain and maintain access

With respect to the wider academic audience, the research approach must be sufficiently robust to survive scrutiny and to provide some unique contribution to the IS field. The researcher's primary constraint within this project was that of maintaining a separation between that of the subject area of the PhD i.e. business process modelling, from the wider aims and goals of the RAMESES project, i.e. to develop a risk assessment strategy for small to medium sized enterprises.

Having identified the influence on the research approach by the first two target audiences, the only additional effect of the wider IS academic audience was considered to be the need for the research approach to lead to credible findings which would provide evidence of an understanding of the issues within the community and which were relevant to their own practices of IS research, thereby encouraging self-reflection from the individual researcher. Credibility could be achieved through the use of a research method which was accepted within the community and through the engagement in empirical contexts through which the theoretical perspectives could be illustrated.

Finally, the identification of an IS practitioner audience for the research reinforced the need for a research approach which provided in-depth knowledge of the research issue. Some of the academic community believe that IS practitioners want 'quick fixes' and 'easy answers' (see the findings presented in Chapter 6), but for those who are reflective the most interesting and useful results are the 'real world' stories and insights which can be related to their own experiences (Schon (87). The author's background in IS practice may add credibility to the work for others in that community, especially if the work is of a critical nature. Future research will utilise the findings from this work and incorporate their dissemination into its own research process.

The research methods available in IS

In making a selection of a research method, it is important for the researcher to be critically aware of the assumptions underlying each method and any implications this may have for its use in practice. This echoes the suggestions of Flood and Jackson (1991) in discussing of their System of Systems Methodologies for IS development. The practical use of IS research methods can be flexible and may reflect the research approach adopted by the researcher and their personal skills in carrying out the research. The important factor is whether use of the particular method in that particular instance provides a good understanding of the research area under investigation. A method may be used rigorously in a number of different ways.

There is a large amount of literature describing and categorising research methods used in IS, the aim here is not to review it all but to provide an indication of the options and issues involved in selecting an appropriate method for the research. The IS field has been dominated by the use of positivist approaches utilising such research methods as surveys, experiments, but there has been encouragement in the literature for researchers to use case studies, ethnography and action research.

The applicability of such approaches to the areas under study in IS argues itself for a broader range of approaches and a move away from an 'unthinking' acceptance of traditional methods (Galliers (1991), Walsham (1995). Since this research was started in the mid-1990s, there has been much written to encourage researchers to consider the use of interpretive and qualitative work, indicating exemplars for such approaches to provide criteria for judging such research (Markus & Lee (1999), Klein & Myers (1999), Walsham & Sahay (1999).

It is interesting to reflect on the work by Wastell (1996) concerning the notion of 'methodology as social defence' within the IS development context. From case studies in organisations, it was noted that both IS practitioners and managers used the structure and rigidity of formal IS development methods as a defence against their own responsibilities or lack of control within projects, hiding behind their adherence to the rules and techniques of such methods in the face of failure or crisis situations, using the method to reduce their anxiety. Perhaps the situation of methodology as 'social defence' is slightly different in IS research, but there may be some security in the well-established and accepted methods of the positivist approach and the statistical analysis of quantitative data. People know what to expect and how to judge the process and outputs of such methodologies. Those working in intrepretive and critical research become aware of the risks in terms of the outcome of the research, and of the ability of the researcher to actually carry it out and present the findings effectively.

Methods within the project

The factors which affect the relationship between existing IT systems and business processes, and which will therefore affect the risk of changing either of these are the subject of the RAMESES project. The research was underpinned by a socio-technical systems approach to legacy systems (Mumford and Beekman, 1994), since the interaction between the human and automated aspects of a business process can aid the identification of potential risks. The understanding and ability for SMEs to perform a business process modelling activity was a fundamental aspect of the RAMESES project and was primary in the approach to risk assessment. This research was conducted by the investigation, validation and evaluation of a business process modelling method within a staged case study approach.

This initial approach taken by RAMESES was qualitative, however, issues began to arise where the qualitative approach no longer satisfied the situation and it became obvious to the research team that more quantitative data was required for the purposes of validation. Within the initial three case studies data yielded insight into the issues that surrounded the factors that impact upon change. The factors under consideration related to:

- the type of systems within the organisations
- the staffing expertise which supported such systems
- the methods adopted for the management of business support.

It was difficult to make comparisons between the data sets in order to improve our understanding of the wider role of systems within SMEs. In order to explore the relationship between individual organisational positions quantitative tools were developed that could yield comparative results.

Supporting the research process

Supporting the research process, resulted in the exploration of the concept of the research life-cycle, which is discussed below. This concept required the use of multiple methods to enable an appropriate outcome to be achieved at each stage of the process. The approach taken has resulted in an oscillation between the use of qualitative and quantitative research methods and techniques. The data gathered, supported the comprehension of the shared understandings that surround the action and artefacts of the organisation through the use of hermeneutics which was in essence qualitative. A quantitative and statistical approach supplied information for the validation of this understanding. The methods which have been employed at the different stages in the research lifecycle are shown in Table 1.

Life cycle stage	Methods available	**Methods applied in RAMESES**
Identify area of concern	Observation Understanding	Observation Understanding
Explore	Grounded theory Ethnomethodology Case studies Participant observation	Grounded theory
Generate theory	Literature review Combined with knowledge gained from exploratory phase	Literature review Combined with knowledge gained from exploratory phase
Apply theory	Questionnaires Participant observation Interviews	Interviews
Generate hypothesis	Factorial design Controlled experiment	Coded information for emergent hypothesis
Test Hypothesis	Experiment Questionnaires	Hypothesis developed into questionnaires
Validate Hypothesis	Inferential statistics Heuristic devices	Comparative statistical and heuristic analysis undertaken
Test result against new area of concern	Action research Case studies	Data collected from new case study for validation

Table 1: Populating the research life-cycle in RAMESES

The phases of the research life-cycle

In this section the various stages of the research process and the techniques and methods selected for their exploration are further discussed. The discussion is focused on the problem domain at each stage of the research process and the methods and techniques, which were applied to achieve results.

Identify 'area of concern'

From within disciplinary paradigms the 'real' world aspect of situated research demands an approach which can remain meaningful for all concerned. The 'real world' situations which were encountered by the research team (consisting of an anthropologist, mathematician, business strategist, production engineer and a software engineer) developed a rich arena of issues to be explored. The issues that were raised for the research focus had to include technical issues of software engineering, organisational issues of strategy and social issues relating to change in 'doing the business'. The research objective was to investigate the factors which impeded the change to legacy systems or business processes in small to medium sized enterprises in order that effective risk assessment strategies could be sought.

Explore domain

Understanding the specific needs of small businesses was the key to the development of the method for the RAMESES project. The research method selected needed to allow the exploration of a complex and multi-faceted environment, this being an important aspect of any 'real world' scenario. Therefore, in summary, the method for this phase of the research lifecycle had to be:

- inductive
- qualitative

- flexible in terms of research techniques that can be used
- suitable for the time frame of the project
- investigative not prescriptive, and
- not reliant, in the first instance, on previously reported IS research

The grounded theory approach (Glaser and Strauss, 1967) matched the second stage of the research lifecycle because the problem under investigation was situated within an environment which, to a large extent, had not been examined by the information systems field. In using grounded theory the concept of business process and IT change was explored without imposing the generalisations gleaned from research focused on large-scale corporations.

The initial investigations were conducted using semi-structured interviews, taking a socio-technical approach, aiming to identify the soft structure. Questions were directed towards firstly the social aspects of organisational change, secondly the technical aspects of organisational change, and thirdly a systems aspect which we aligned with the managerial aspect of organisational change. From these three aspects we investigated three organisations using a combination of interviewing and mapping techniques, which are discussed in greater detail in the next chapter.

The interviews were recorded and were later transcribed (see appendix 3). This transcription process provided the material for further analysis. The analysis of the transcriptions involved coding material into a series of emergent issues. The primary issues which emerged included the role of 'piece-meal' systems in small organisations i.e. systems made up from a combination of 'off the shelf packages', a lack of professionally trained staff, resistance and fear to the introduction of new information systems from the employees. The analysis of this data laid the foundations for the development of a method of data collection to elicit organisational understanding.

Generate theory

In this phase of the research a literature review was conducted in order to seek alignment with the research findings from the exploratory phase. Literature was reviewed from a number of sources, disciplinary areas, fields of interest and appropriate journals. There was a lack of research into small organisations which was relevant to the scope of this project but which incorporated software engineering, requirements analysis, risk assessment and analysis, business process-reengineering, amongst others. From the critical evaluation of this literature against the finding of our exploratory study we developed a method of investigation to guide the next phase of the research.

This stage focused on which data needed to be gathered and the issues that the analysis raised to identify the most pertinent and useful aspects of organisational analysis. Taking the three perspectives of the sociotechnical system as a starting point has lead to the development of an ontology, which seeks to represent all three of these aspects. This ontology has identified issues relating to organisation, business process and IT system as being the key to a sociotechnical understanding. The method framework, which has developed as a result of the combination of preliminary empirical research and the subsequent literature review, has a matrix of information as its tool for undertaking risk analysis.

In the first stage of the method, data was collected in a factual manner which related to the type of organisation being studied, the way in which their business processes varied from generic processes, and the sort of IT which supported those processes. In the second stage, in-depth data was gathered from the perspectives identified as pertinent from the identification of the problem boundary. As organisations problems or needs are generally 'wicked' then setting the solution space is imperative to identifying the issues which require attention. The third stage takes both sets of data and by comparative means seeks to weigh up the risk of any proposed change. This method framework is laid out in figure 1.

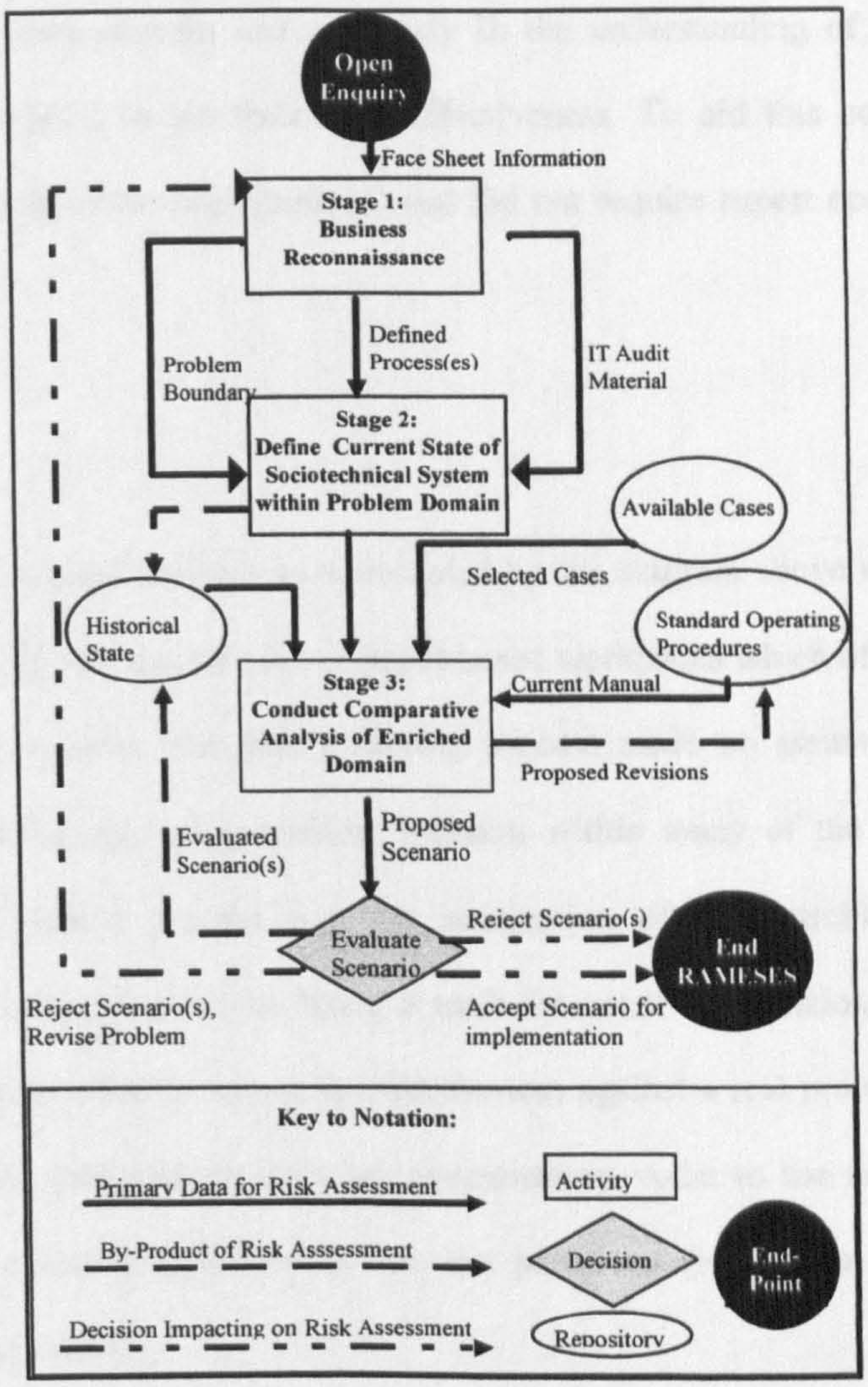

Figure 1: Diagram of RAMESES method.

The literature review supplied a number of tools and techniques mostly generated from research into large organisations that were currently available for the analysis of organisations from the perspectives that had been identified. The tools were evaluated against the data gathered from the SMEs in order to ascertain their appropriateness. Many of the tools examined would have been unsuitable for the domain in which this project was situated as they were reliant on expert knowledge of systems, process modelling or managerial studies that were not prevalent in the companies under investigation. It was the contention of the research project that small organisations had expertise in their own domain and obviously in the understanding of their businesses that needed to be made explicit to aid their own effectiveness. To aid this contention the method developed was accessible to the organisations, and did not require expert operation in order to be enacted.

Apply theory

The method of organisational analysis as represented by the diagram above was tested in a further two organisations through the application of paper based workpacks which offered a semi-structure to the data gathering process. The data gathering process made no assumptions relating to the structure of the organisations being studied. Inherent within many of the techniques examined within the literature review process was the assumption of a hierarchical organisation; our qualitative data did not support this as being a truth for small organisations. The data collection process was then implemented to assess its effectiveness against a real problem domain. The data collection process was designed to allow an emancipatory voice to the users of systems under investigation and to assess the relationship between perceived views of an organisations' system and those identified in practice.

From the initial data gathered and the literature reviewed for the purposes of theory generation it was apparent that SMEs are often at the mercy of professional systems designers and analysts. All of the companies interviewed had war stories of expensive systems failures were implementations had not yielded results and had left employees feeling inadequate in relation to the systems introduced. They had little confidence in system suppliers, felt exploited by their need for systems and hostaged to a market place in which they had inadequate knowledge to make informed decisions.

The RAMESES method was an attempt to level the playing field by advising them of what data they could gather to inform this process and offering them a method which they could apply that would better inform their system implementation process. The organisations in the second phase of the research were able to assess their position in relation to systems or business process change. This involved the effective gathering of the information which revealed the 'as is' position of the organisation. This included maps of business processes, explicit knowledge of the organisation structure and decision making routes as well as a thorough audit if the IT systems in place and their relationship to business processes (Mallalieu, Harvey and Edwards, 1997). Whilst by this stage an effective method for data gathering had been developed, and an understanding of the analysis process into the risks involved in change was still unclear. The next phase of the research explored the mechanisms by which the data could be more fully utilised in order to aid risk assessment.

Generate hypothesis

A fundamental problem in the analysis of the data gathered above was evident from within the research team. The Weberian adage of don't mix 'is with ought' became an issue of contention. Although the literature reviewed supported the difficulty in such a separation, (Giddens 1989) the multi-disciplinary nature of the team revealed difficulties in data appraisal. From the risk perspective it was essential that the 'is and ought' nature of the data became comparable. Ulrich (1986) argues that contrasting 'is' and 'ought' boundary judgements provides a systematic way to evaluate content. The comparison was between what an organisation was and what it wished to become, it was necessary to attempt the compilation of meaningful information from disparate and not easily reconcilable data sets.

In order to achieve a method of comparison further analysis was undertaken to explore which factors were fundamental to the 'riskiness' of a project. From the data sets gathered at the test sites a number of hypotheses were generated in relationship to the analysis of the data gathered. This next task was to consider the manner in which sense can be made of the data gathered using the RAMESES method. This activity was based on the formulation of hypotheses which were used to explore the relationship between variables within the data set. The focus of data analysis within the RAMESES method is on the identification of factors that affect the ability to change in order that a risk assessment could be undertaken. It was essential that data analysis enabled and supported the risk assessment.

Within RAMESES risk was thought to reside within the potential change which is under consideration and the current organisational position, data analysis must therefore explore the relationship between the current State and the potential State after change. Each hypothesis will consider a different aspect of the change position within the RAMESES data sets. Below is an example hypothesis.

Hypothesis 1: Risk lies in the difference between movement from State A to State B:

Where A = current State

And B = envisaged State

'State' can be located within parameter

System i.e. technical change

Process i.e. business change

The process of validation required the development of measures that would stand up to comparative techniques if a risk assessment was to be developed. The measures adopted were mostly simple statistics which allowed for a great deal of flexibility in the subsequent analysis. The quantitative measures allowed for the revelation of issues which, could lead to further focused analysis of the qualitative data previously collected or a new focus to re-interview and collect new data sets.

Test hypothesis

Hypotheses were developed to aid the analysis of each of the data elements that were gathered. The coverage of the data was validated by the population of table 2 below. Each sector of the table had a corresponding data source within the RAMESES method and its resultant workpacks.

The data networks identified in table 2 aided the assessment of the organisations current state, the organisational audit included data from a socio-technical systems perspective to ensure a wide range of coverage. In terms of the risk assessment data all the positions covered were populated with subjective data. The auditing process endeavoured to gather data from multiple viewpoints regardless of organisational power, the importance of role or the politics of the process in which individuals were involved. The IT system audit endeavoured to gather data which identified which systems were operating in each discrete task within the business processes under study. This gave an indication of the relative importance of each software component. This data was supplemented by data which verified the skill level of the user at each task point. The user attitude to the system was also investigated. This compilation of data offered a fairly thorough picture of the issues that would impact if system of process was to undergo change. The data was then to be compiled in multi-layer process maps which showed firstly the relationship between process and system, secondly the expertise levels of the users within that process and thirdly the user attitude to the system in relation to business effectiveness. The future position of the organisation also had be considered. In terms of the risk assessment risk resides in change to either process or system therefore details of the proposed change also had to be considered and the data gathered.

	Business Process	IT	Organisation	Future Position
People	Role Activity data	Skills assessments Individual attitudes to IT	Organisational consensus	Identified training goals
Data type	Qualitative/ quantitative	Qualitative	Quantitative	Qualitative
Analysis by method	audit	Correlation of variance	Correlation of variance	Risk assessment
Technology	System flow	IT Audits	Organisational attitude to IT	Potential IT system outcome
Data Type	Qualitative	Quantitative	Qualitative	qualitative
Analysis by method	Flow diagrams	Statistical assessment	Correlation of variance	Risk assessment
System	Perceived and actual heirarchies	Organisation and role of IT	Organisational understanding and competitive strategies	Improved decision making
Data Type	Qualitative	Quantitative	Qualitative / Quantitative/	Qualitiative
Analysis by method	Correlation of variance	Correlation of variance	Scored	Risk assessment

Table 2: Data networks

Validate hypothesis

The analysis of the data gathered from the second stage of data collection enabled the revision of the initial method. The revision related to the comparison the business process identified in the organisations with generic processes. The notion of generic process as a means of process improvement was discarded at this stage. It became apparent from the data gathered that small organisations are a source of innovative process in which their competitive advantage lies. Trying to enact a 'one size fits all' policy of business improvement was potentially detrimental to the competitive state of the organisations.

The data gathered from the previous phases was used to populate the developed workpacks (see appendix 1). The data sets revealed much about the current state of the organisation, its IT systems, the abilities of the workforce and the strategy of the management in relation to changes. From these data sets the key indicators that affected the risk of systems change were identified, they included experience of handling change, the size of the project in question, the rate of which change was to be undertaken, the degree of knowledge available relating to the task in hand. For these factors to be accounted for within a risk assessment method, the data gathered by the application of the RAMESES method was essential. The risk assessment task itself relied upon an honest analysis of the experience of project managers to undertake such changes in order to identify accurately a potential set of solutions.

The issues identified in this stage meant a series of revisions were made to the method, which was then retested in a new domain.

Test results against new area of concern

The final stage of the research project was to test the revised method. A new case study was selected and the method was employed. The problem under investigation was the failure of an ERP (Enterprise Resource Planning system) implementation.

The organisation had undertaken a systematic and thorough process of requirements analysis and product selection involving multiple stakeholder groups and incorporating the notion of key users. The business had undergone a business process modelling exercise which revealed potential improvements to systems in accordance with notions of business process re-engineering (Hammer and Champy, 1993) to support the new system implementation. A substantial training package was incorporated into the incremental system roll-out.

Despite rigorous measures to establish a successful adoption strategy the organisation after eighteen months of effort had little confidence in the ability of the system to support their business needs. Action research was selected as an appropriate method for this stage of the enquiry process as it required a method that which gave primacy to the knowledge and expertise of the user group (Baskerville & Wood Harper, 1996). The RAMESES method was applied to the organisational problem domain and proved effective in from several perspectives.

Firstly, the company managed to assess their own position using the workpacks provided with support and guidance in how to use the method from the research team. The data gathered structured their IT audit which despite this particular organisation unusually having an IT department had not been effectively undertaken prior to the research teams intervention. The process also gathered a full set of organisational process maps, which were validated as accurate by the process models gathered prior to their ERP implementation.

The data set which combined the business processes with the software that supported the business functions invalidated the organisational perception that the implementation had failed. The system was shown to be effectively supporting the business process except in one area which had sullied the entire project. This problem was the result of a system bug which related to a system change from the standard package, which was due to be rectified by the next upgrade. The key issues in the perception of failure related to organisational politics and a power struggle between departments. Several recommendations were made to the organisation in order to improve the users perception of the system which are discussed further in chapter 6.

Limitations of the chosen research approach

In all research the researcher makes decisions concerning perspectives, in particular, in the areas of standpoint, selection and interpretation (Dahlbom and Mathiassen (1993). The adoption of a critical approach was inherent to the research domain. Since the researcher had acknowledged that these are perspectives rather than 'objective' stands, and is bound to make them explicit, the results are then open to alternative interpretations. The author does not claim to have found the 'right' or the 'best' method for this study, but believes that the chosen research approach provides a good vehicle for the work given the factors involved. One of the criticisms to be argued about such research is that, due to it's stated exploratory nature, 'what the researcher intends to be the essence of the study is what others consider the necessary background work in order to begin' (Benbasat (1989).

The research project is itself a process of reflecting upon the process of research within the perspective of IS, meta-level research. To consider the results in a positivist light would be to ignore the human aspects of the investigation, where the subjects' explanations of their view and behaviours and the researchers interpretations of their statements, were both subject to the notions of formative context and distanciation and appropriation (Ciborra & Lanzara (1989), Boland (1991). The contribution to IS is intended to be in terms of the empirical application of a critical approach to business process modelling in the SME domain, Lyytinen (1992) stated that most critical research undertaken in IS related to theoretical perspectives and advocated a need for further empirical studies.The difficulties in enacting such an empirical study will hopefully offer insight to future IS researchers. Such researchers may utilise the insights of the findings as a persuasive tool (Fitzgerald (1991), and as a means of eliciting interest among the practitioner community of the theoretical results. One possible outcome may be that it will encourage others to consider similar reflections of their work.

Research can be viewed as about sharing stories which reflect the researcher's experience and priorities, etc. (Boland (1991), Sahay & Walsham (1995). Information is passed on through the appropriation of consistent and convincing stories by the individual hearing, or reading, them. The lessons learned are not always those intended by the teller, but then, the hearer integrates ideas gained within their own experience and priorities, in order to bring about change in their world. Through a critical approach, the researcher can use their story to enable the reader to question their presence in the research and that of individuals and community being described, rejecting the notion that they can somehow innocently write descriptions of others (Suchman (1995). Indeed, Checkland (1981) insisted that it is essential 'always to include in a description of human activity an account of the observer and the point of view from which their observations are made'.

The validation of the choice of research method, and the techniques used, are part of the evaluation process of the research. The inclusion of the *weltanschauung* of the researcher as a major criterion, necessarily means that any validation must be considered highly subjective, and will be measured by the conclusions abstracted from the analysis rather than by objective tangible measurements (Fitzgerald (1991). Fitzgerald, in trying to identify a means for validation of his work, looked at how IS development techniques were validated, and found little evidence for this anywhere in the literature. He noted that it was usual for techniques to be simply described, with authors relying on illustrations to be sufficiently persuasive to validate themselves. He stated that 'We still have the ethical burden of trying to demonstrate our technique's strengths and weaknesses, of establishing under what circumstances it is thought to be more applicable and also, under what circumstances it is thought to be less applicable.'

A piece of critical research the work should also provide the reader with a critique of forms of domination, asymmetry and distorted communication in the research situation through showing how social constructions of reality can further certain interests and alternative constructions can be obscured and mis-recognised (Deetz (1996). The work should also strive to achieve the fundamental criteria for human well-being and emancipation in its process and aims, by addressing Habermas' technical, practical and emancipatory human interests (Jackson (1992): in assisting the material well-being of the social system through improved productivity; in promoting mutual understanding among individuals and groups; and in encouraging open interactions free from the constraints of power and distortion.

Concluding remarks

Reflecting on the metaphor put forward by Gummesson (1991) of an area of research being like an iceberg: an iceberg only shows 10-15% of its mass above water, the researcher who wants to see what is really going on needs to look below the surface. In this chapter the author has presented her thinking and evaluation of the IS literature in her choice of research approach for the investigation of business process modelling in SMEs.

The choice of research approach has been made in the light of five factors of the research: the author's experience and underlying epistemology; the research issue which viewed business processes in an holistic sense as an aspect of IS research: the intellectual framework supporting the research which was based upon viewing the target domain through a Multiple Perspectives Approach; the researcher's assumptions about the target audiences for the work; and the research methods available within the IS field. In this chapter these factors are discussed and the author's choice-making made explicit for the reader.

The research approach, was chosen to combine the strengths of the author, in the light of the stated framework, to provide predominantly qualitative data to richly illuminate the research issue. The approach would be carried out within a critical research perspective, with the interactive nature of the case studies providing an opportunity for learning on the part of the researcher and an environment for discussion which would extend into the broader IS community

CHAPTER 5

The research in practice

Introduction

This chapter sets out the phases of the research process, in section one the context of the case study organisations is summarised in relation to the research process. In section two the detail of the initial exploratory process is described through the data gathered in companies A and B. The RAMESES method was developed as a result of this investigation and is explained in section three. Section four demonstrates the application of the method to company C and supports the findings with illustrations from the interview process. The final stage of this process considers revision to the method following appraisal and evaluation in case studies D and E.

The context of the case study organisations

The research was carried out in three phases, each with their own case studies. The fieldwork was conducted at five manufacturing organisations and at one organisation in the retail and distribution sector in the Northeast of England (see chapter 3 for full details).

Where the RAMESES project is aimed at producing a tool, which allows risk assessment within SMEs of changes to business processes or to IT systems, this thesis focuses on the development of a business process modelling technique that supports this process. The solution therefore requires that the problem be analysed in such a way as to shed light on the organisation, its IT and the way in which people use it. The interconnectedness of these factors made it complex and false to disconnect the business process modelling technique from the additional material collected in the RAMESES method. It was therefore necessary to include the whole method in section four, the process modelling technique is however the focus of chapters six and seven. The research was conducted by the author as research fellow and a research assistant, the division of the work stemmed around the technical requirements of the system. The research assistant focused on the technical aspects of the research undertaking the IT auditing of the organisations, whilst the author undertook the social and systems aspects focusing on the organisational and business process analysis. This approach is aligned with a socio-technical systems approach (Mumford & Beekman, 1994), which seeks to integrate the social, the technical, and the organisational aspects of an open system.

Company	**No. of Employees**	**Research Phase**	**Timetable of events**
A	50	Phase 1 – exploratory investigation	July 1997 – December 1997
B	70		
C	80	Phase 2 – validation of findings and development of method	January 1998 – June 1998
D	100	Phase 3 – testing evaluation and revision	July 1998 – December 1999
E	90		
F	180	Evaluation and Analysis	January 2000 - December 2000

Table 1: Company situation to research process

In this scenario an environment is investigated from the following three perspectives, the social, the technical and the system, this was broadly aligned to read that:

- the *social* perspective is equivalent to people factors,
- the *technical* issues relate to the information system,
- the *system* relates to issues of the organisation as a whole

From gathering this data a rich understanding of the organisation begins to emerge. However, it was then necessary to decide on the viewpoints from which to gather the information as a wicked problem is a deeply tangled and enmeshed entity. There are an infinite number of viewpoints on the problem both from the outside and from the inside of the domain. It is necessary to derive precise criteria for deciding where the viewpoints for one's study of the problem are. In this study, it was known that the area for study was the relationship between legacy systems and business processes. It was assumed by the author that the relationship between legacy systems and business processes is supposed to be close. Whilst many factors may affect this relationship, the focus for the research is that the closeness or coupling in a relationship will be manifested by the presence or non-presence of a gap. A large gap in the relationship between the legacy system and the business process is indicative of an area of high risk. A large gap may imply a lack of data integrity, work having to be redone, processing bottlenecks or muddled responsibilities. Therefore, it was necessary to choose viewpoints on the RAMESES problem domain which would detect such a gap. Both a business process and a computerised software system may be viewed as a sequence of events. Both may be characterised by the fact that the way that events are designed to occur is not always the way that they actually occur when the system/process is in use. The way they are supposed to occur should leave very little gap between the two, but the way they actually occur will reveal the gap. Therefore the following viewpoints for study were chosen:

- The functional view, which expands the top-level knowledge of the organisation.
- the process view describes a business process from, for example, the receipt of an enquiry to a paid invoice,
- The cellular view is a bottom up approach, which seeks to explain how the process actually happens.

This understanding encompasses organisational type, managerial culture and strategy, issues of power and information, all in all this involves a plethora of facts and fantasies. From the issues that have emerged during the case studies, a generic view of the scenario has been assembled. This has been used to produce an evolving model of the linkages between the different factors in the problem-solution space. Figure 1. (below) shows this model, relating the organisational viewpoints to the perspectives accorded by the socio-technical systems approach (Mumford & Beekman, 1994) where IT is information technology and BP is business process.

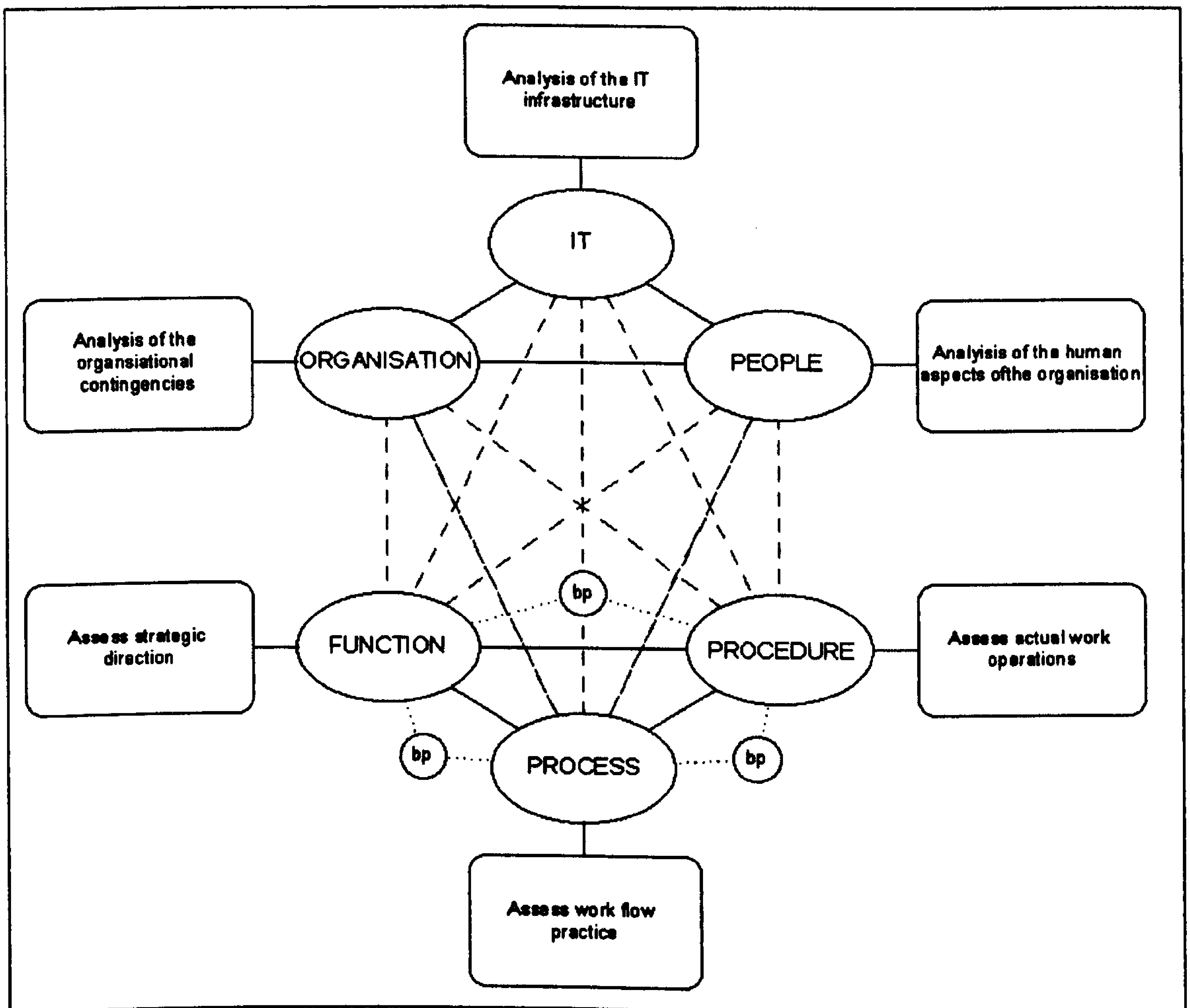

Figure 1: Model showing linkages between perspectives

By understanding the problem and the solution from the aspects denoted within the diagram a more holistic account can emerge.

Research techniques

The systematic analysis of the organisations is dependent upon a variety of research techniques. Individual situations of investigations may require different forms of study. The key practices used in this project are observation, informal and formal interviewing, documentation review, system and process audits. These approaches offer a degree of triangulation within the data collection process by approaching the problem arena from differing perspectives. Within the first phase of the research the chosen method of data collection is a combination of semi-structured interview backed by process mapping. At any stage within the collection process the data gathered may be analysed to provide a systematic categorisation of the findings. Categorisation requires the identification of characteristics within the data and the identification of relationships between those categories. Having identified the characteristics and pertinent relationships between them the next essential step in terms of informing the method is to allocate weightings to the results.

The outcome from this level of investigation is a 'rich' understanding of the interactions between the business process that we are investigating, the people responsible for the implementation of those processes and the relationship of the process and people in regard to any information system, which exists in support of that process. The generic qualities of process and interactions emerging from this deep understanding informed the evolution of the method.

Interviewing protocols

The protocol devised was to tape record the interviews and enhance the data with the construction of maps of the functional area under the managers command. There were no objections raised to recording the interviews: however, it became apparent that the greatest difficulty in tape recording interviews is that much of the best information is relayed to the interviewer after the official interview has been terminated. Whilst the tape recorder is running the interviewee is focused on the task in hand. However, when the business of the interview is concluded most interviewees continue to talk informally about their work and the company. Much of this information is extremely valuable in terms of a rich understanding of the company culture. However, the fact that it is 'off the record' means that it would be, perhaps, unethical to divulge it in written appraisals of the task. This information can therefore be used only to inform the researcher, for instance, as how to best approach people, or to have awareness of political situations that may be sensitive. The ability to make the most of an interview opportunity depends upon the reflexivity of the researcher in reading the situation. Alienating interviewees by appearing unsympathetic or by holding a controversial opinion can seriously impede the process of data collection.

Phase 1: case study: evidence of the mapping process

The interviews were reinforced through the construction of maps, which laid out the role of managerial functions; this enabled a more thorough understanding of the data being collated. By mapping the area being studied the interviewee could improve upon the understanding of the interviewer and further clarify points of confusion. The more complicated the function the more relevant the role of the mapping became. The hand drawn maps have been duplicated within this section in their original format to avoid a further level of interpretation. The maps (for example see fig.2) were hand drawn during the interview then analysed using a SSADM tool (see fig.3). Although this was an interpretative process, care was taken to ensure the meaning of the data was not altered.

Transcripts and emerging themes

Another key task in the research process was the transcription of the interview data. Full transcripts were made of the interviews, which were then subject to analysis. From the analysis of the transcripts themes were identified as being pertinent when they reoccurred in the data. Transcripts were analysed for emergent issues and previous academic work on the subject was sought. This iteration between data and theory is a feature of research conducted within a grounded theory framework and reinforces the rigour that such interpretative studies require. From the emergent themes two key sets of information were identified. Firstly, information which is specifically related to the company under investigation, these sets of themes identified the areas of concern or of interest that were context dependent. The second sets of themes were those of a more generic nature and progressed the advancement of the RAMESES method.

Examples from the case studies

This section seeks to illustrate the different techniques adopted within the initial stage of the investigation. Having given an overview of the research project, the processes of interviewing and mapping are explored and supported with the case study material.

The initial data collection process consisted of 35 interviews with various managerial and support staff from the initial three case study organisations. The interviews ranged from around 20 minutes to one hour depending upon the complexity of the interviewees' position. To illustrate the means by which information was collected and subsequently analysed, extracts from the case studies have been included. In the initial meetings with the companies' general managers information was gained about the size of the company, its area of business and their expectations of the research. Information was offered on what achievements were sought and the amount of time that would be spent on data collection. Arrangements were also made for the next meetings at which time data collection could commence.

Setting the scene

The preliminary meetings took the form of an "informal chat" with the project's sponsor in each company. Attempts were not made to pre-empt the results of this meeting by setting a formal agenda, the approach was to talk to the key stakeholder of the project within the company and find the issues that he considered to be pertinent, using his knowledge of the company to direct the research. (In each case, the sponsor was a "he".) However, each meeting was entered into with the express purpose of setting future dates.

In company A, for example, this meeting lasted for about 30 minutes and the technical director explained in general terms the structure of the company, a company "who's who" and his understanding of the research project and what he thought it would offer them. The date was set for another more formal interview where it was intended to map the functions that he oversaw and to identify the people who also had a managerial role. This meeting set the agenda for the first round of formal interviews. By this point an impression was held of the overall company structure and the duties that the technical director undertook. It was obvious from the description of the technical director's role that his duties were varied and widespread throughout the company and that a method had to be devised that would enable the complexities of his role to be disentangled: this resulted in the interviewing protocols described below.

After this first round of interviews, more formal sessions followed. The protocol for these had been adopted from previous studies and found to be suitable. This was to tape record our interviews and enhance the data with the construction of maps of the functional area under the manager's command. No objections were raised to the recording of the interviews although, as ever, some of the most pertinent information is spoken once the tape recorder has been switched off.

The formal interviewing process

The first of the formal interviews was with each company's technical director. Each had been instrumental in the formation of the company and possessed the engineering expertise on which the business was founded.

To explore his viewpoint a combination of qualitative research techniques was used. The focus was a semi-structured interview: the interview commenced with a description of the type of information that was needed for analysis, as the interview progressed a 'rich' diagrammatic map (see figure 2) of the functional viewpoint was drawn primarily by the technical director with the researcher intervening in the process where required.

A typical question asked was "Could you describe your role, the tasks you undertake and especially how they link to the other departments?" The initial information received was a list of the other directors, managers and key workers in the administrative roles. This was a valuable piece of information as it gave a structured picture of the key company staff (although much of this information could have been taken from the company handbook, which had been written by the technical director). Although a copy of the quality manual had been provided that included this information, the addition of personal descriptions of the task and the person who carried it out was useful and enlightening information.

In company A, all of the information was presented by the technical director in a very formal and structured fashion: it was tempting to attribute that to his engineering background, as this structured and hierarchical view was not given by all of the interviewees.

The technical director was involved in a key position in many of the company's functional areas, which made it difficult in some ways to disentangle his roles. He had written the quality manuals of the company for the British quality standard, ISO 9000 accreditation and was also the key quality controller. During the interview a large map of the function that was being described (this is shown in figure 2) was drawn.

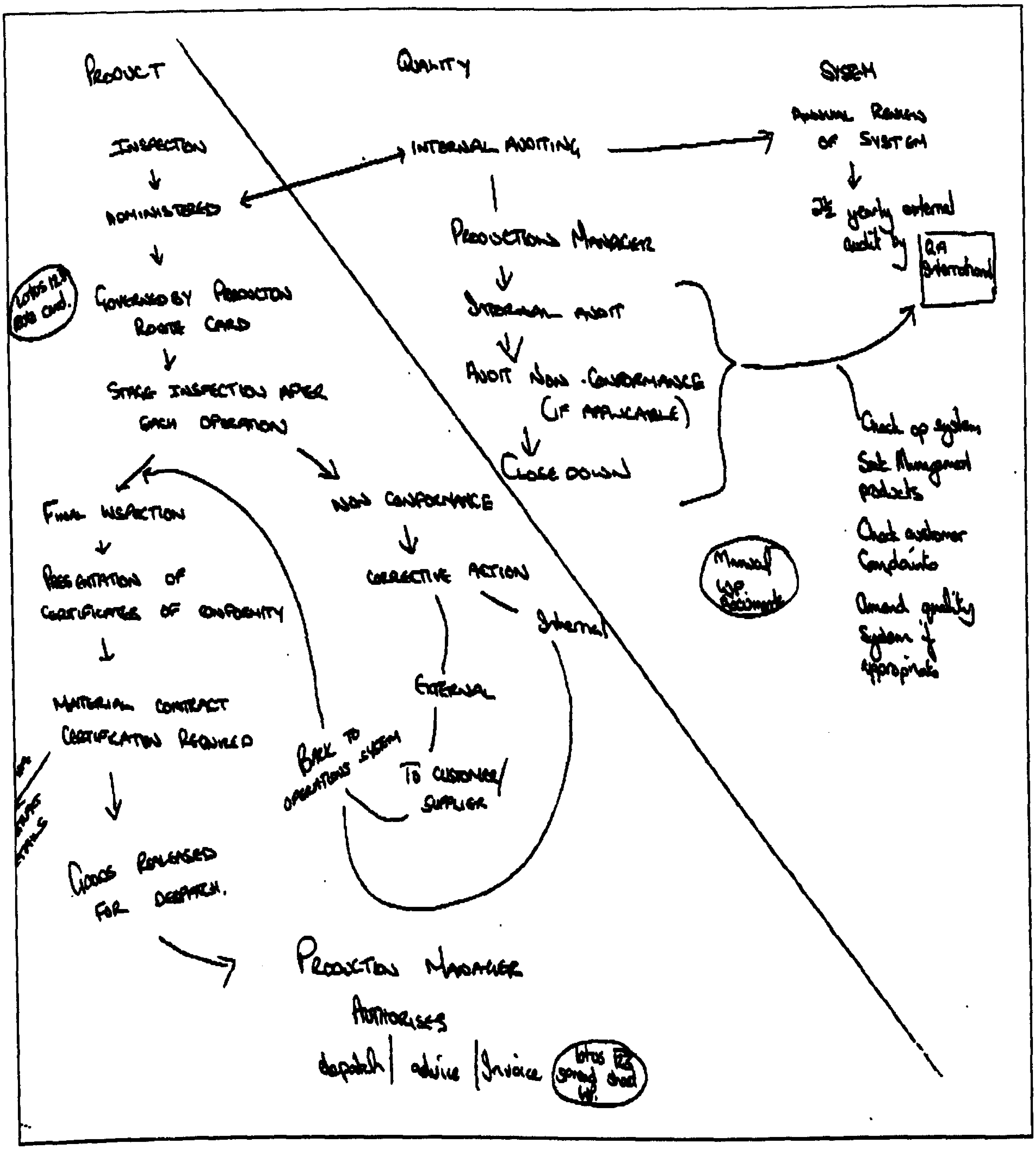

Figure 2: Quality map from Technical Director of company A

Onto the functional drawing which described his role, the individual processes that were supported by some sort of IT were clearly marked. The location of IT support at this functional level was marked, and further supported that investigation with a round of technical interviews to firmly map the IT system and its impact upon the organisational process.

Company A's technical director had developed his own technical support tools to assist in performing rough calculations when conducting estimates. He entered the various design parameters into a BASIC program that he had written, which then performed the various calculations. The outputs of this program were entered into an estimating package that had been purchased from the USA (this was a Maths CAD package which incorporated an interactive screen). The results from this were then entered into another self-written program to conduct further calculations. In total he used four programs for one quotation, and had to re-type the outputs of each previous program as inputs to the next. It was apparent that the technical director's use of the computer was as an automation of the manual process, and did not use the computer to inform more advanced processes. The software had been developed in-house by the technical director, and it was his attempt to put his years of experience into performing the calculations in software terms.

Other management tools were integrated as part of the Lotus suite, these were used for support and to provide him with the information he required in order to carry out his managerial functions. The original computer software contained an accounts system, over time the system was improved with the addition of a word processing package and CAD software, as well as the "little bits" of his own software that enabled him to do various other jobs within the department. The technical director described the system as "piecemeal". It was currently useful just for the elements that he did, although he did consider that his tasks would be aided by some form of integration, perhaps development of an integrated package on the network. He confessed that he was the only person able to use his personal packages; which are used for the design procedures, including quotations (at this time all the technical quotes were processed by him). The director expressed a desire to make this more interactive or perhaps user- friendly, so that anyone qualified to do so could perform the estimating process.

The rich maps

After the combination of a functional interview (to gather information about the technical director's role) and the technical interview (to establish the support offered to that role by the company's IT system) the information was transferred from the large hand drawn maps to a modelling tool. The translation process itself was a very interesting one, for the researchers had to be aware and alert to the temptation to restructure and influence the data that had been gathered from the interviewees. The aim was to transcribe the view as expressed by the technical director but to put it into a format that was more amenable to analysis at a later date. The rich maps that were drawn of the processes were translated into digital format using an SSADM tool. Using the tool allowed us to construct diagrams in a standard format, from the information given regardless of the form of the initial rich maps. Figure 3 shows an example of such a translation for the Technical Director.

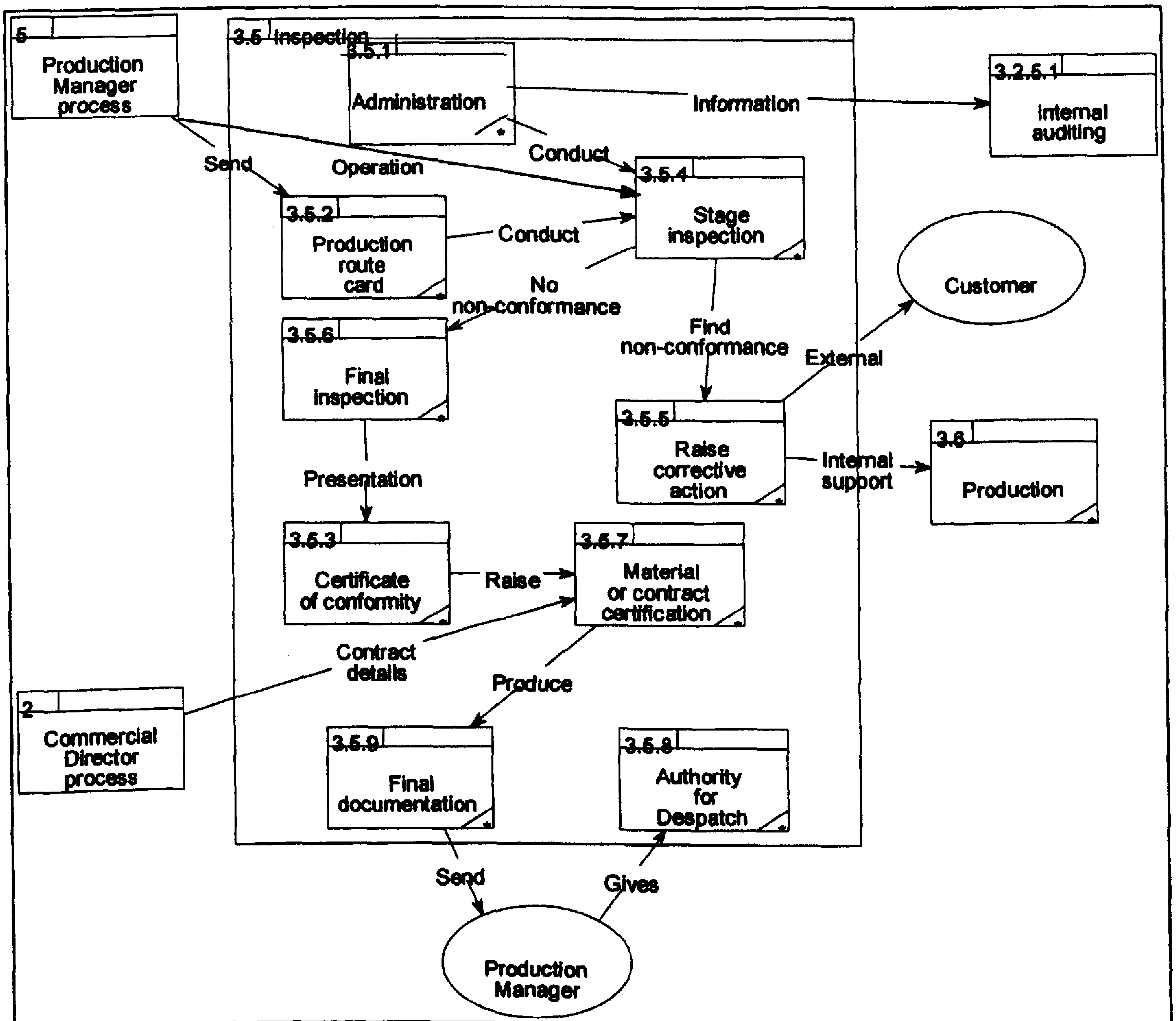

Figure 3: Transcribed "Rich map" of the Technical Directors quality processes for company A.

Rich maps were constructed during each formal interview with the top-level management of the company these were then transcribed into the standard format. This meant that using the individual section maps (which were each, initially, very different in character) an overall picture of the organisation was developed. The use of the tool was advantageous during the subsequent analysis of the data. A colour-coded approach was used so that, although there was a standard format to the organisational/IT support maps, the sections could still be identified. This colour coding enhanced the clarity of the picture developed and as a result the initial stage of data collection and analysis identified two major areas of concern for the company.

Although the tool gave us a good representation it was not flexible enough to incorporate all of the information that was needed to present the complexity of the findings and the methodology of SSADM was somewhat at variance with the overall aims. Using the tool the tendency was to force the information given in interview into structured and hierarchical formats, which was not necessarily how it had been presented. It took restraint from the researchers not to impose the limitations of the tool upon the data that had been collected. The data gathered represented a complex and varied environment which was through the eyes of its owners and whilst the structure which lay beneath the data was observable, the integrity of the viewpoint which under analysis required that the researchers understanding was secondary to the interviewees. The maps of each director's functional areas were compiled to create an organisational mapping. This mapping gives an overview of the company, its key figures, main processes and highlights some areas of concern.

Transcripts and emerging themes

From the initial interviews several themes emerged from both a context dependent and generic perspective. For example, within this case study context dependant issues related to data, much of the data within this organisation was transferred by manual re-entry, this issue was relayed in several of the interviews and so became the focus of 'focused' coding where data issues were sought from subsequent transcripts. Issues relating to the handling of data have informed the development of the RAMESES method in that it is one of the means by which the state of existing systems may be categorised.

Identification of areas of concern

The first concern identified was that the technical director carried too many sets of responsibilities, which is a risk to the company if any events occur that mean his knowledge is no longer available to them. The second concern was that the role of efficiency suffered an overall lack of recognition from the directors: this was evidenced by the lack of acknowledgement of the role that job costing played within the organisation's procedures. The General Manager had already highlighted these issues as being of strategic importance and saw the organisational map as a support for his objectives.

Studying the business processes

The second stage of the organisational analysis revolved around a specific business process within case study A. Once the initial functional analysis was completed the second stage was to follow a business process from enquiry in to payment of an order completed. Understanding the business process involved a 'walk through' one of the business processes identified by the company. The managing director and researcher followed the trail of an enquiry, by collecting all relevant documentation, and discussing with each employee involved what tasks they undertook to fulfil the order. This information was then plotted onto the organisational map drawn from the first round of interviews. The objective here was to seek points of complexity, bottlenecks or smooth processes from the comparison of the two sets of data. This analysis again raised the issue of the complexity surrounding the technical director's function, as he became a bottleneck for progress as so much work revolved around his contribution.

Phase three was to study in-depth the issues that arose within the first two investigations although in this particular study it would have been politically difficult to substantiate the required work due to the seniority of the person involved.

Results

The results from stage 1 of the project focused on using the data gathered and the issues that the analysis raised to identify the most pertinent and useful aspects of organisational analysis. Taking the three perspectives of the sociotechnical system as a starting point has lead to the development of an ontology, which seeks to represent all three of these aspects. This ontology has identified issues relating to organisation, business process and IT system as being the key to sociotechnical understanding. The Method framework, which has developed as a result of the research, has a matrix of information as its tool for undertaking risk analysis is described below.

Phase 2 - Evaluation of the Rameses method

From the initial results of the project the RAMESES method has been developed with a primary focus on assessing the risk of change to either IT or business process. The foundation stone on which the risk assessment rests is a thorough organisational understanding of the components-based system. The depth of system understanding which results from undertaking the RAMESES process is designed to aid small organisations in the management, maintenance and improvement of the component bases system. This section details the method and its implications for such systems.

RAMESES is composed of stages for data collection, data analysis and decision checkpoints. These are integrated into a systematic approach to allow the assessment of risk of change to be considered in a methodical manner. In each stage the stakeholders who have responsibility for providing data, analysing it, or evaluating the resultant proposals are clearly identified: and their input to the stages are clearly specified. In this way we can ensure, for instance, that data is collected from appropriate people, at the right level of detail at the relevant time. This delineation of tasks and responsibilities provides the control mechanism that is required is to ensure that method provides meaningful results.

Figure 4. outlines the stages of the method within which there are three data collection stages: Open Enquiry, Business Reconnaissance and Sociotechnical System Audit within the Problem Domain. For each of these the users of the method input the organisation's data that is needed to allow the risk analysis of the proposed change to be made. Data is collected via the use of workpacks, and each of these stores information of two basic types:

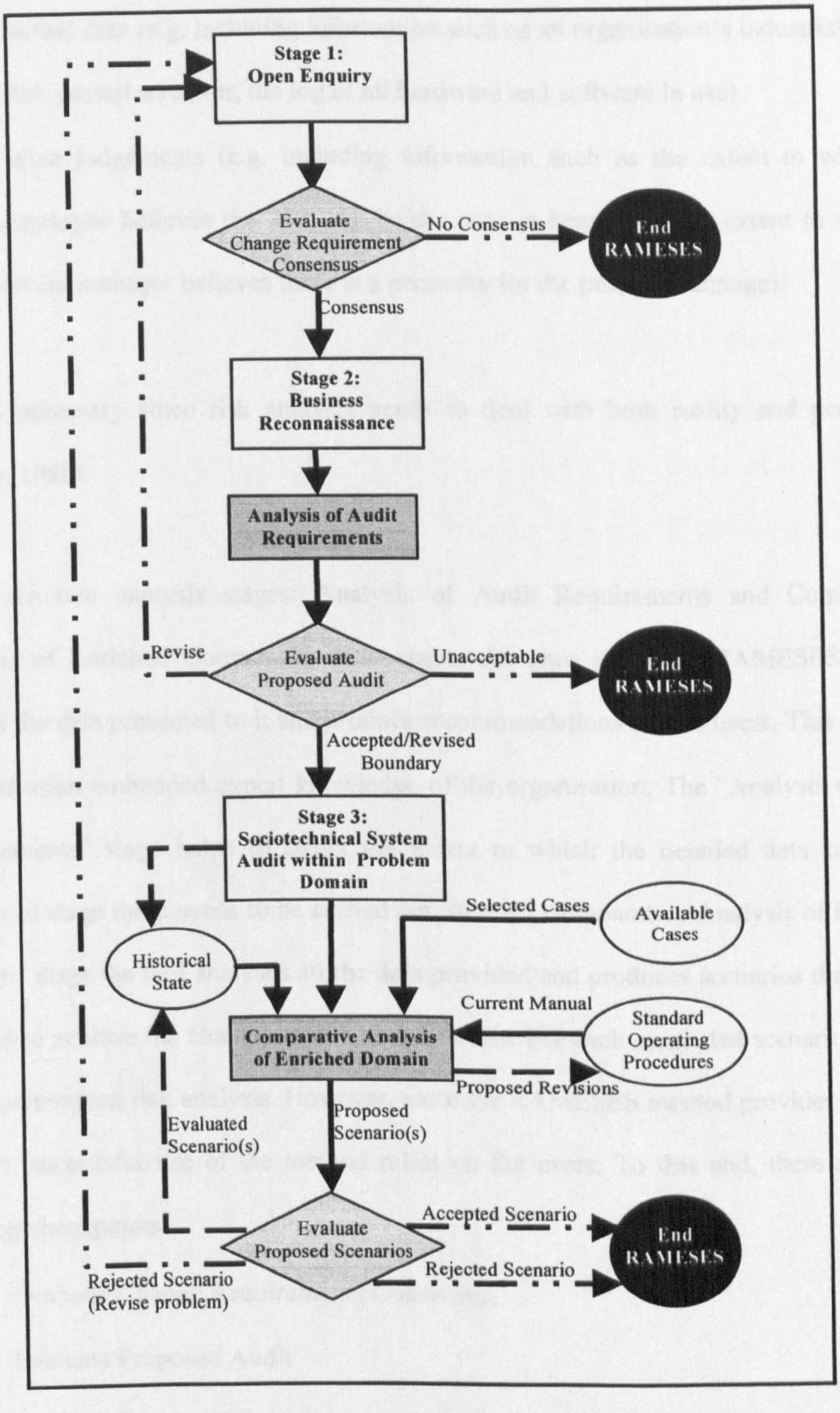

Figure 4: Overview of the RAMESES method

- factual data (e.g. including information such as an organisation's industrial sector, size, annual turnover, the log of all hardware and software in use)
- value judgements (e.g. including information such as the extent to which an employee believes the software he/she uses is beneficial, the extent to which a senior manager believes there is a necessity for the proposed change).

This is necessary since risk analysis needs to deal with both reality and perception (Arthur, 1988).

There are two analysis stages: Analysis of Audit Requirements and Comparative Analysis of Enriched Domain. In these stages the onus is on the RAMESES tool to analyse the data presented to it and produce recommendations for the users. This analysis is based upon embedded expert knowledge of the organisation. The "Analysis of Audit Requirements" stage helps to target the extent to which the detailed data collection process in stage three needs to be carried out. In the " Comparative Analysis of Enriched Domain" stage the tool analyses all the data provided and produces scenarios that can be adopted to achieve the change required by the users. For each suggested scenario there is an accompanying risk analysis. However, since the RAMESES method provides decision support, successful use of the method relies on the users: To this end, there are three decision checkpoints:

- Evaluate Change Requirements Consensus,
- Evaluate Proposed Audit
- Evaluate Proposed Scenarios

For each of these the senior management evaluates the recommendations made by the RAMESES tool and has the option to accept, revise or reject them.

Data collection is a key aspect both of risk assessment (Kontio, Getto, Landes, 1998), and of the RAMESES method and is discussed in some detail here. Each data collection stage is specified for the users in terms of: a summary of the stage, the inputs to the stage, the personnel expected to provide the data collected, the steps of the stage, and how the data is analysed using RAMESES method. Then each individual step is specified in terms of: its objective, its inputs, the personnel expected to complete the workpacks, and the workpacks to be used. Any particular step can require the completion of a number of workpacks, and each of these workpacks may need to be completed by a number of specific employees. This breakdown of the individual steps allows the users to be guided in not only providing the required data, but also in ensuring that the correct people are targeted to provide this. Figure 5 provides an example of a typical step specification taken from the method.

Step 3-IT: Define IT Systems Components within Boundary

The objective of the step

Here the IT components used in support of the business tasks (within the problem boundary) are logged. Information is also gathered about how the acquisition and maintenance activities were carried out. The definition of the IT components will include any commercial off the shelf packages such as Microsoft office suites, CAD systems, and any bespoke software written to support individual tasks.

Inputs:

Business users knowledge of IT use

Personnel expected to complete the workpacks.

All those who undertook step 3-BP.

Workpacks to be used.

WP-TTITC: Task Trail IT Component

WP-ITSC: IT Audit of Software Components in Use

WP-SCAS: Software Components Acquisition/Implementation Strategy

(One of these is completed by each staff member identifying IT components in WP-TTIC).

Figure 5: Example of a step specification

Stage 1: Open enquiry

In this stage the senior manager initiating the use of RAMESES ("the Initiator") provides three different sets of information: (i) The change that is being considered within the organisation: RAMESES focuses on providing a risk assessment of the implications of making that change. (ii) Basic, factual, information about the organisation (for instance: industrial sector, number of employees, annual turnover). (iii) The names and roles of the senior managers within the organisation. The senior managers, thus identified, are asked to calibrate the extent to which they agree with the need for the specified change. All the senior managers (including the Initiator) are also asked to assess the extent to which the organisation's current IT systems support the business at a strategic and operational level.

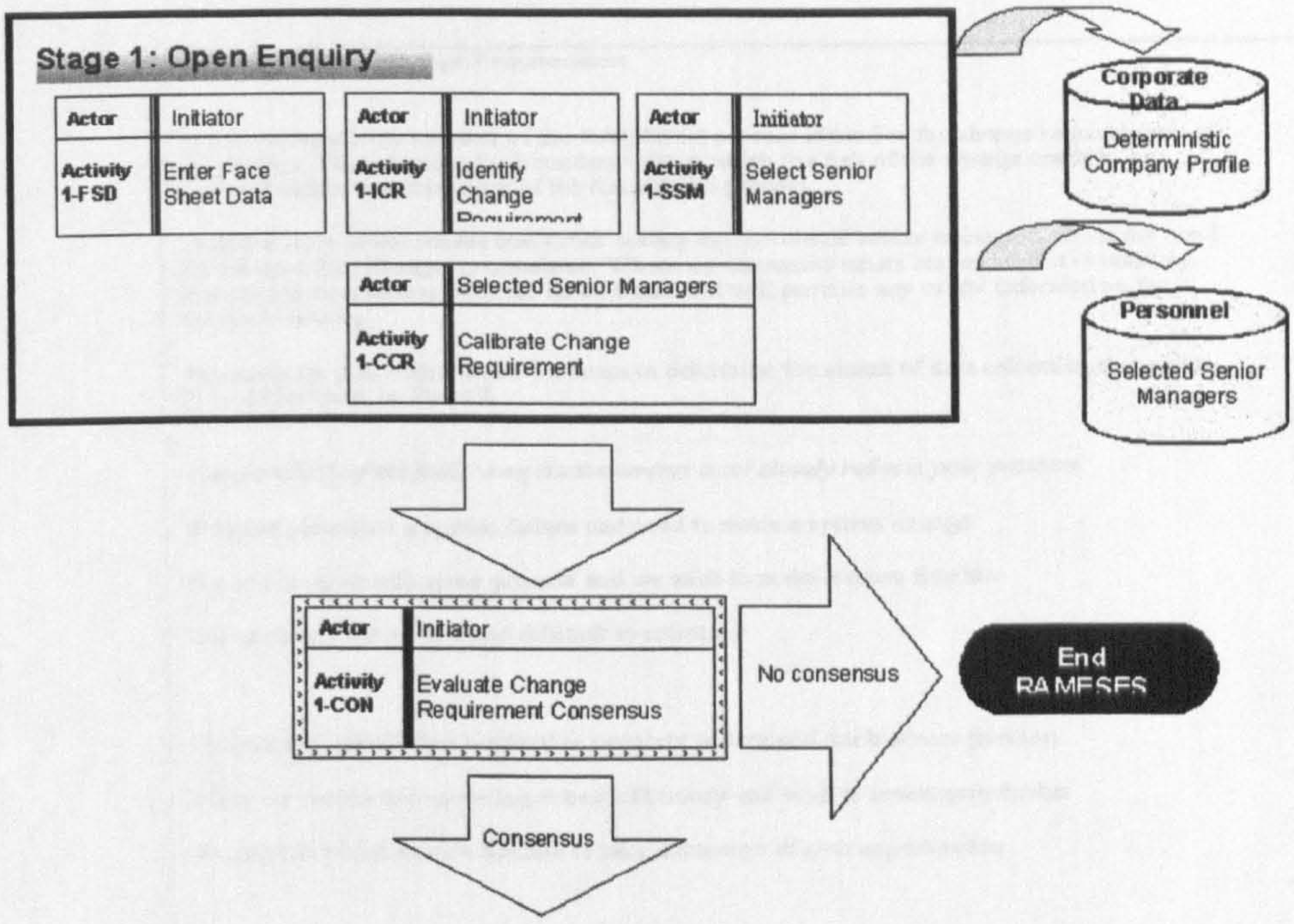

Figure 6: Components of stage 1

The data that is collected within this stage summarises the senior managers' understanding of the business environment in which the organisation operates, the organisation's profile, the need for change and the IT support available to the business processes. Figure 7. shows an example workpack used to identify the change requirement.

WP-DCR: Define Change Requirements

In this workpack the initiator of the RAMESES process identifies the change requirement of importance. This provides the boundary within which the risk of the change needs to be assessed within the remainder of the RAMESES process.

Then the level of consensus that exists among the individual senior managers, about the need for the specified change, is measured. Where no consensus exists among staff it is unlikely that progressing further with the RAMESES tool will provide any useful information for decision-making.

This package acts a filtering mechanism to determine the extent of data collection that needs to be undertaken in Stage 2.

Choose which of the following six statements most closely reflects your position

We have identified a system failure and need to make a system change ☐

Our system is dictating our process and we wish to make it more flexible ☐

Our system is out of date and difficult to maintain ☐

We lack the information we need to properly understand our business position ☐

We know we are not operating at best efficiency and wish to investigate further ☐

We need to become more flexible to take advantage of new opportunities ☐

Other (please state) ☐

____

____

Figure 7: Example Workpack WP-DCR

This data may also be used to build a historical profile of the particular organisation over time. To this end, where RAMESES is used on a number of occasions over time, an explicit record will be kept of how the organisation has changed. This corporate memory may aid any future decision making process.

Stage 2: Business reconnaissance

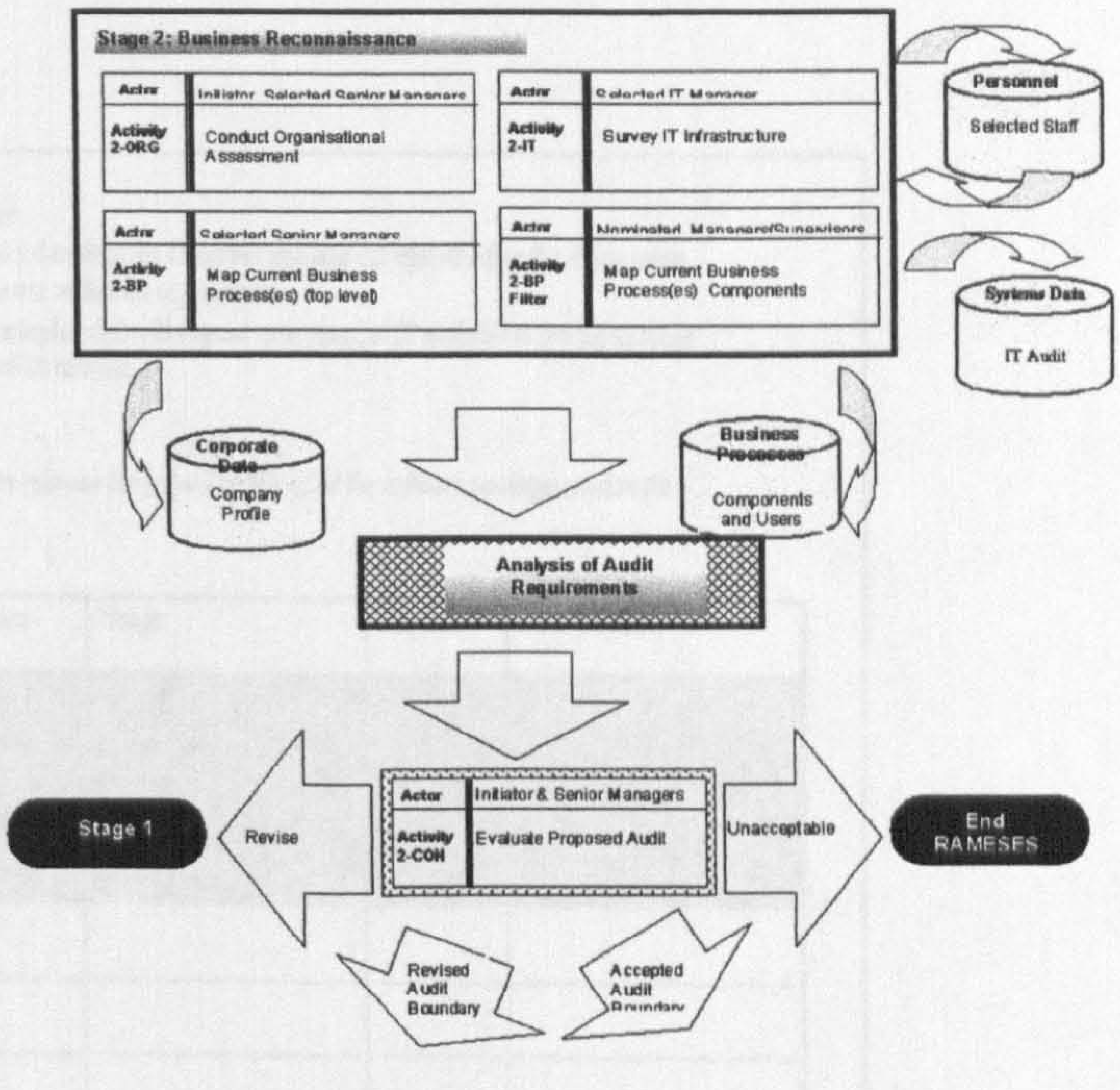

Figure 8: Components of stage 2

In this stage data is gathered from the managers selected by the RAMESES Initiator. The data is gathered to provide a top-level picture of the organisation from three perspectives: (i) the organisation (the company's culture), (ii) the relevant business processes and (iii) systems support (the IT)

The selected managers identified in Stage 1 are required to complete workpacks to show how the company fits in, and reacts within, its environment. This data hinges around the use of the Miles and Snow (1978) model implemented in the Conant et al. (1990) questionnaire. The model takes account of the relationships between organisations' strategies, their business environments, structures, cultures and management processes. The model classifies organisations according to their overall generic strategies and according to the types of strategies that are used by their marketing, operations and administrative functions.

WP-ITS: IT Software

This workpack gathers data from the IT system manager (or equivalent) in the organisation about the software in use within the organisation.

The time needed to complete this will depend upon range of IT available to the organisation but should not exceed 20 minutes.

Please indicate in the relevant box(es) the profile of all the software packages used in the organisation

Application Software	Usage	Version	Date Installed
e.g.			
Sage Sterling	Accounts	6.1	Oct 96
Fred's Estimator	Quotations	0	Aug 85

Figure 9: Example Workpack WP-ITS

At a systems level the senior managers with responsibility for the business processes affected by the proposed change provide a high level mapping of the process components and those staff with responsibility for them. Whereas, the IT manager (or an equivalent) is charged with logging all known IT within the area of concern: including hardware, software and communications components. Figure 9 Gives an example from this stage (WP-ITS) used to log the software known to be in use.

The aim at this stage is to provide data about the organisation in its current state. The analysis stage "Analysis of Audit Requirements" uses the data provided here to propose the scale, depth and breadth of the audit that needs to be carried out in the next data collection stage. If the proposed audit is accepted (as outlined or with revisions) the next data collection stage is started. In that stage the data will be gathered at a lower level of detail from a wider range of personnel as identified within the analysis stage. If the senior management team cannot agree to progress with a proposed audit then the use of the tool is at an end.

Stage 3: Sociotechnical system audit within problem domain

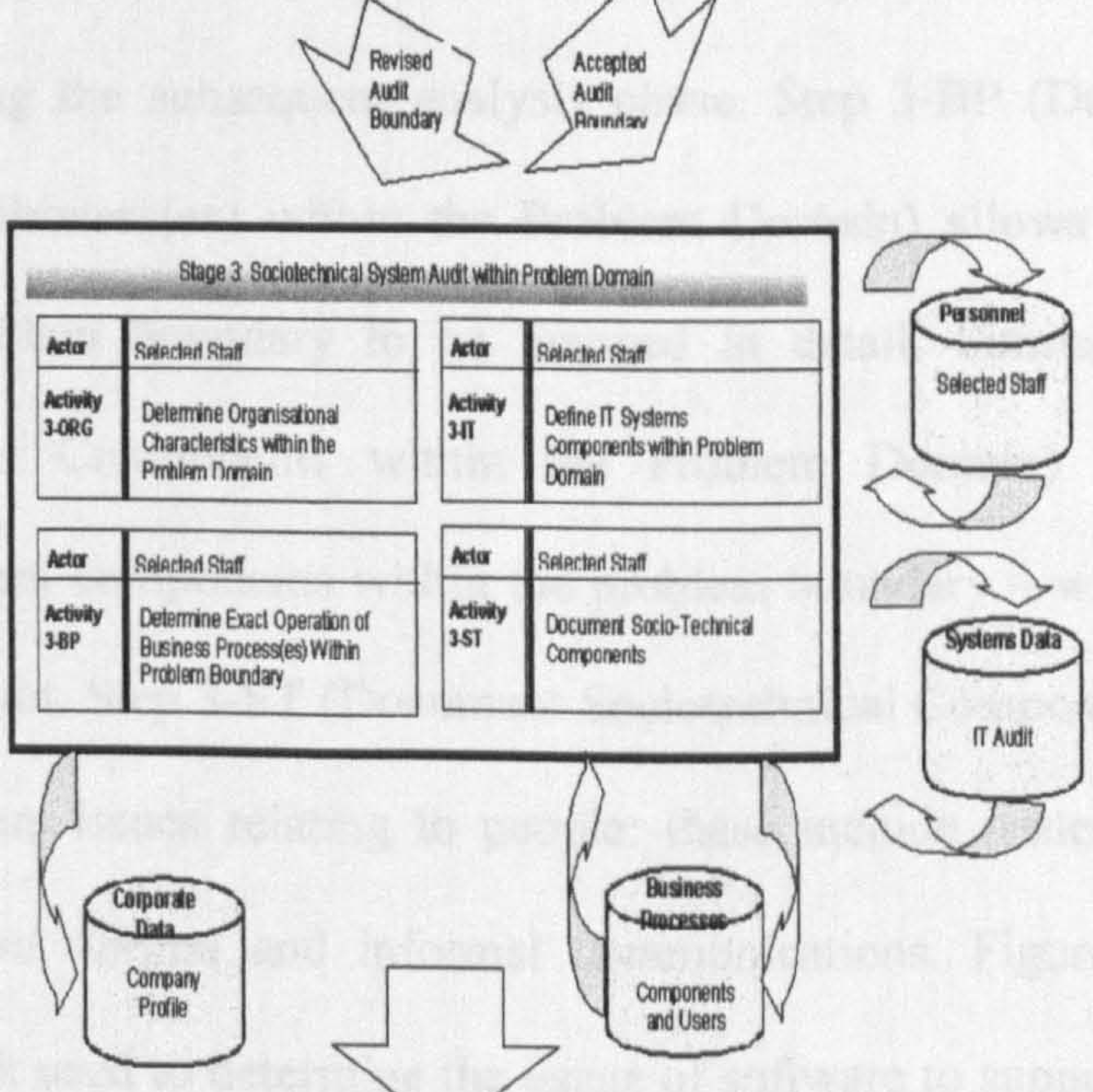

Figure 10: Components of stage 3

Staff working at an operational, rather than at the managerial level provide detailed "low level" information (facts and perceptions) during this stage. Their specific knowledge about the way in which business activities are undertaken is coupled with their understanding of the use and aptness of any software components support. The personnel selected to complete steps are selected by managers as a result of decision checkpoint 2-CON (Evaluate Proposed Audit) in stage 2 (see Figure 9). These staff will be within the defined change requirement boundary.

In Step 3-ORG (Determine Organisational Characteristics within the Problem Domain) they use the questionnaire that was also completed by managers in step 1-ORG. This allows comparisons to be made across functions within the organisations and also across hierarchical levels during the subsequent analysis phase. Step 3-BP (Determine Exact Operation of Business Process(es) within the Problem Domain) allows each business process within the problem boundary to be mapped in detail. Similarly, Step 3-IT (Determine IT Systems Components within the Problem Domain) results in the identification of all system components within the problem boundary – whether they are officially sanctioned or not. Step 3-ST (Document Sociotechnical Components within the Problem Domain) gathers issues relating to people: these include issues such as skill levels, training provision, formal and informal communications. Figure 11.shows an example of the workpack used to determine the usage of software to support the business process tasks (WP-ITSC).

WP-ITSC: IT Audit of Software Components in Use

This section is used to collect the data that is needed to identify and profile the IT acquisition /procurement and implementation strategy adopted to fulfil a specific business need. Therefore, an individual profile is constructed for each software component within the change requirement boundary.

(Time allowed 30 mins, depending upon scale of system)

Name of respondent:	Position:

Software Component Breakdown

Name:	Hardware platform:	Operating system:
Fred's Estimator	PC 286	Windows 3.1

Belongs to Software System:	Belongs to Business Process:
Job Costing	Customer Quotations
How was it acquired:	**What did it replace:**
Developed by the user	Manual activity
Year 2000 compliant:	**Euro compliant:**
N/A	Don't know

Figure 11: Example Workpack WP-ITSC

The objective of this stage is to collect a detailed view of how the organisation operates in practice – within the area of interest. Data collected includes how the processes are undertaken, how they are supported, the extent to which any IT support is seen a beneficial. These data sets and those collected in stages 1 and 2 are used within the subsequent data analysis stage "Comparative Analysis of Enriched Domain" where gap analysis is performed. Gap analysis is used to identify the areas in which the different understandings of the organisation can impact on the perceived risk of change. It is also used to assess the match between the current organisation "as is" the planned change ("required outcome") and known, evaluated solutions, which exist in the RAMESES "available cases" repository.

Case Study : Application of the data to the method

Within the first phase of the research the data was collected from three of the participating companies in a qualitative fashion, using a case study approach (Bergner et al. (1998). The data was analysed and the method was developed as a result of that analysis. The next stage was to apply the method to the corpus of qualitative data. This case study considers the analysis of one of the companies studied through the RAMESES method: throughout the section text in *"quotations"* reports direct statements made to us by the interviewees at the company. The case study is reported in the following sections.

Background to the case study company

Company C is a retail distribution company with around 80 employees which had undertaken a formal business process reengineering of the organisation along the lines recommended by Hammer and Champy, (1993) before our fieldwork began.

Within the company, business process reengineering exercises had been carried out by internal teams supported by consultants.

> *"We used consultants at the start, but we were determined that we weren't just going to get people in who were going to walk around making copious notes and then come back and tell us what to do."*

In the first instance, the company had realigned its activities and personnel to match the identified core business processes. This had exposed a mismatch between their unaltered software systems and their now, processually defined structure.

In the early days of the company the role of software systems was considered at a fundamental level. The impact of IT was therefore accounted for at both the macro and micro levels: at the macro level, strategic decisions relating to provision, from both a financial and personnel viewpoint, enabled a company wide commitment to the successful integration of business and IT processes. The founding director had been very keen to use IT to support business processes. The company was seen at this time to be unique and as such, had acquired state-of-the-art hardware and had encouraged the development of complex in-house software systems.

The applications that had been developed by the software engineers ran on the company's centralised mini computer. The systems had evolved over a number of years to support the warehousing and order processing side of the business. The functionality in the software was entirely specific to the company. The intrinsic nature of this IT legacy meant that a high correlation existed between the software system and the everyday activities of doing business.

As a result of their BPR exercise a need emerged for accurate management information: which lead to an explosion in ad hoc PC based systems development.

> *"..most of the PC's we own were bought during the BPR period, and a lot of them were bought specifically to enable people to manipulate information like that"*

Development activities have now switched to users developing their own software routines within commercial-off-the-shelf packages. However, in doing so the close link that had previously existed between work practices and software strategy has been separated. The empowerment of individuals has led to a degree of disconnection whereby much information is re-entered at different locations with little in the way of version control being present. A lack of integration which has grown from a need for accuracy threatens the ability of the company to assess its current situation.

> *"we have little or no management information available, so the whole basics of BPR where you say this is what we do, this is what it costs us, these are the statistics involved......we couldn't do any of that"*

Many political issues marred the BPR exercises undertaken by this company which were exacerbated by a change in the business climate. The original intention had been to better employ staff freed by more efficient working practices. Unfortunately a difficult business time, led to major redundancies. Trust in future reengineering was therefore unlikely to be forthcoming and suspicion in future attempts would make requirements elicitation difficult.

Open enquiry

The collection of data in the open enquiry workpack identified typical benchmarking type factors. This includes identifying information i.e. name address telephone number logistics information such as number of employees, turnover, and information relating to the market in which the company trades. The identification of the company within the external environment, in terms of turnover, logistics, market situation, brought notions of commonality which had previously been lacking within this organisation. This confirmed empirical data collected from the managers.

"you tend to think that what you do is unique. There isn't another business like it, and we had always taken that kind of approach to both our IT and our business processes."

Define driver for change

The first step is to identify the nature of the problem which is under assessment. The problem boundary for this company was wide-ranging since the nature of specifying a new system within a changing environment required thorough organisational analysis. This involved the completion of all of the prototype workpacks. The objective for this company was to specify a system which would offer IT support for the rapid transfer of strategic information.

"..when we look at new IS systems, of building systems that can send information backwards and forwards...in a much more effective way than we've got at the moment...so that we can become much more responsive to changes in demand and /or much more responsive to changes in cost."

Another key factor already identified was the need to purchase a COTS (commercial –off –the-shelf) package to support their business activities. This approach was adopted in response to the difficulties experienced by the organisation since most of the staff which had originally been responsible for the development of the current software had left the company. This meant that maintenance of the current system has been costly and difficult.

"and the staff we have are totally taken up with supporting a groaning system anyway"

The move to a commercially developed package with its support package is seen as the most cost effective means of system maintenance.

"Whereas now that we've reached a point where we're looking around the IT market place, saying, what is available, what a company would do, what is the set-up to do this kind of thing. There is a vast number of suppliers out there who could do what we want it to do, but we've been totally unaware of that outside world, both in terms of IT and in terms of process."

This is a major shift in strategy for this company who have recognised comparability in how they and other companies operate. As a result, the old belief that they were in a unique position has given way to a new stance of simplified and effective business processes being supported by commercially available software. The key to successful change was identified, in-house, as being the correct and accurate specification of the new systems. Thus a strategic role for IT in enabling business development was identified. Whilst IT had always been important to this company this shift in attitude was aligned with a newly identified need for speed in responding to change, thus maintaining competitive advantage.

Case study company C: Stage 1 of RAMESES - business reconnaissance

Stage 1 gives the structure for the collection of three organisational profiles. The profiles are collected as discreet entities and give the 'Macro' viewpoint of the organisation.

Step 1-ORG Undergo Organisational Assessment

The data which was collected at this stage related to organisational issues and factors. This data revealed organisational characteristics from a macro level and identified a company which was flexible in its approach with a flat management structure.

> *"The crux of the business must be about doing that, rather than building departmental hierarchy"*

This analysis seemed to reveal a modern organisation capable of coping with and even embracing change as a potential for growth. The data here identified the organisational factors which impacted upon the implementation of change.

Step 1-BP Map current business processes

The second step collects data which describes the perception of the existing business processes. In this episode of data collection the interviewees described what they identified as key processes.

> *"...And so we see four processes happening within that. Our product developing and ...sourcing process, and inward supply logistics and outward customer logistics and a customer recruitment and retention process, basically."*

The recent BPR exercise made this process easy to execute to some extent.

"..when we first started talking about BPR, we did it for anything that we did"

This descriptive process again takes a macro level view of the business processes from the perspective of the manager of the organisation. One objective of the organisation was as follows:

"So there's a need basically to simplify, simply for the process of simplification"

This was seen as being the most efficient way forward for the company, which was suffering an escalation of costs with no commensurate increase in sales.

Step 1-IT Identify IT system information.

The third step in the stage one collection process logs all IT systems. Because of the evolutionary nature of systems development within this company, a high degree of complexity existed within the IT system. The hardware within this company consisted of three mini machines, one UNIX box, and thirty PC's of various specifications. The software available ran on several different operating systems, some of which had technical support and some of which did not. It was impossible to identify degree to which the systems were Y2K compliant and it was generally acknowledged therefore that they were not. There was no company standard for office packages. Backups were left to individuals on the PC's, whilst the IT department scheduled backups for the mainframes. The task involved in compiling this information gave the organisation a feel for the depth of the problem, which they had previously only suspected.

"..but the structure of the programme seemed to disintegrate and it was quite hard to tell what was going on, who was doing what, what was expected of you by when."

The collation of factual information in a structured manner gives organisations an opportunity to understand in a simple fashion the complexity which can undermine the success of system changes.

Case study company C: Stage 2 of RAMESES - define current state of socio-technical system within the problem domain

The description of the problem boundary in this example involved an in-depth company analysis also being undertaken within the second stage of the RAMESES assessment. This is because their particular problem involved the interoperability between all three perspectives: organisation, business process and IT system. In this type of scenario it is essential to identify where process and IT impact upon each other as well as the organisational issues which affect progress. Without this information the risk of changing either is increased.

"In order to say what you think the company should be and do, you need to know a fair bit about what it already is and does. And the truth is, we didn't know that. Nor did we miss the fact that we didn't know it."

Step 2-ORG Identify organisational attributes.

In comparing the data we collected from shop floor workers with Step 2-ORG we identified a mismatch between the organisational vision of a flat organisational structure with the hierarchies that existed within the organisation. The workforce readily identified the existence of departmental boundaries and were able to illustrate negative impact upon business processes as a result of power politics.

Step 2-BP Identify actual business processes

Step 2-BP exposed problems within the business processes where they impacted against departmental boundaries.

> *"What we said was that the departments were a set-up that had existed and would continue to exist unless somebody did something about it. But the process wasn't three different processes. It could be one ...There was some resistance from the management involved."*

A high level of competition existed between the different departments involved in a process.

> *"Our design and market people here started siding with our suppliers if you like, against our logistics people"*

Various strategies were in place to dominate the operations of the IT service departments. The employees encountered demands for IT service time which they felt were more to do with internal politics, where the sales department were able to secure an urgency of response which remained unavailable to other sections. The outcome of this was detrimental to the general day to day practices in operation.

Step 2-IT Identify IT system information

The analysis the IT system in Step 2-IT showed a real need for integration of data between the various systems that were in operation throughout the company. Data issues emerged that showed a lack of a primary up-to-date data store. This was a key factor in the inability of employees to source relevant management information.

> *"when we access the database we just don't know whether we can trust the information we get. We know by looking at the reports if they take the latest shipments into account or not. It takes up valuable time to adjust the figures manually, it would really help if we only had one version running"*

Step 2-ST Identify Interconnections

In the final level of investigation, Step 2-ST we considered the interconnections between the various perspectives. In Task 2.ST.ORG.IT the analysis exposed a conflict between the role identified for IT within the company and the structure which was in place to support it. The departmental divisions which arose as a result of this were a primary reason for the fragmented PC based informal information system which had evolved. This factional empire building was at the root of information variances.

Task 2.ST.ORG.BP further clarified the dissonance between the departmental functions.

"...they could do the whole job, and not put it into the warehouse in-between, not have to tell the computer that they've done this that and the other and not spend their time writing bits of paper to each other telling them what to do next."

The final Task 2.ST.BP.IT showed the need for efficient information flows more clearly and highlighted the organisations understanding of the interoperability of process and IT.

"..there was a feeling that if we sorted out the processes of what the company does, that will put us in a much better position of saying, this is what we want the computer to do for us. So it was kind of one dragging the other."

Within the business processes much information was being double entered and individuals were unable to act on much of what they received by the existing hierarchies. This lead to inefficiency in both work effort and results.

Case study: Stage 3 - Conduct comparative analysis of enriched domain

The data was collected according to the filtering process (instigated by the drawing of the domain boundary in stage 1) and was analysed according to a triangulation of comparisons. The triangulation process identifies levels of consistency in the collected data between: firstly the organisational/business process and IT perspectives, and secondly the macro/micro levels of data collection.

Recognise the problem domain

The problem domain in this case study identified the need for a thorough organisational analysis. The driver for change in this case study was located in the mismatch identified by the organisation between IT system and business processes. This realisation enabled the company to consider a different approach to the specification of a new system. The integration of the COTS packages which were already supporting their business alongside a more flexible package which they now felt could be sourced externally offered a different route for the process of defining requirements.

The 'Macro' view of the organisation

This stage assembled the Macro level description of the organisation from the managerial perspective. It had been identified that the problem boundary is substantive in terms of encompassing the organisational, business process and IT perspectives. The requirements specification of a new system requires extensive knowledge of all three areas. The following factors were identified:

- that the organisational profile should enable change to be effective.
- that the business processes were identified
- that the IT system was both complex and chaotic

This information was collated as a series of simple snapshot images which build together to form a more complex organisational profile. Profiling is the key to unearthing a manageable method of making sense of a complex scenario.

The 'Micro' View of the organisation

In conclusion, RAMESES identified several issues in relation to the organisation which would have impacted upon the risk of system change. The need to integrate the commercial off the shelf packages to the existing IT system would solve many of the problems relating to a lack of data integrity. The hardware environment was at variance with the organisational aims for communications. How effective any changes would be at this level would be dependant to some extent on the proposed level of investment, the organisation proposed an investment of £200,000 over three years. A need was identified for training in system disciplines and procedures, this would stabilise some of the current data issues and would make for good practice with a new system.

> *"There is also an awareness of continuous improvement that hasn't existed before. The fact that I still spend most of my time looking at how we can do things better next time and next time and next time is a big change."*

Evaluation

Within the finished tool this stage would have to consider similar cases to compare the suitability of previously enacted solutions and other external sources of information which may impact upon the choice of solution. This external information may include relevant legislation, factors relating to hardware or software issues, economic forecasting or the latest training initiatives.

Conclusion

The application of the data to the method allowed as appraisal as to the effectiveness of the method to gather data from the perspectives identified in figure 1. The workpacks had been developed to give coverage to the organisation as a whole with the process auditing packages being fundamental to the outcome. The evaluation of the method confirmed the research approach as data could be matched to all workpacks, at this stage in the project it was felt that the level of coverage was appropriate and that the method needed to be tested in anger in a new organisation.

Phase 3 – testing the method

The third phase of the research project was to test the method in a new organisation that had no prior knowledge of the research project, company D was introduced at this point. The purpose of the testing was to assess the ability of the method to support a small organisation in undertaking a self-assessment of it business processes and IT systems. Having evaluated the system for organisational coverage, this level of testing was to focus on the whether the users of the method could gather such data themselves as this was a fundamental objective of the research.

Case study company E: Method evaluation

The fourth organisation studied had in excess of 100 employees. The organisation was a small manufacturing company producing filtration products for a variety of situations. The opportunity to assess the organisation and to test the RAMESES method was based in a self specified project which sought to assess and improve business processes and the support of the information technology system. The aim of the study was to identify the business processes and the effect of organisational culture upon the information technology implementation. The key stakeholders involved undertook the primary assessments and involved the senior management team but interviews and data were collected throughout the company. The information technology manager was responsible for the project which included a much needed audit of the organisational information technology system. The organisation wished to undergo a business process re-engineering exercise but required a base-line assessment of their 'as is' position in order to effectively plan new and improved processes. The organisation had an information technology manager but no additional support and the system was offering less support than was perceived as available. The project was tied to an aim for organisational improvement which was being supported by an external agency.

In the initial stages of the organisational assessment the research team guided the data collection process. Whilst this was against the initial stance to test whether the organisation could self-assess its position, it was essential to progress the assessment quickly. The IT director was given training in the use of the method and the research team then shadowed the data gathering exercise. The data the organisation collated at this stage was of less interest to the research team than the observation of the data gathering process. The focus from this data was to collect information that would improve the method and enable further ease of use. The shadowing process which also involved some direct intervention at the request of the IT director highlighted a number of issues. The pace of work within the organisation resulted in a number of requests for help within the data gathering process. This highlighted a need for an additional member of the research team. In order that the method could still undergo a meaningful evaluation the new research team member was given a minimal level of training in the use of the method and shadowed alongside the company staff.

The new team member gathered the majority of the data although the production manager also a member of the senior management team avoided the data gathering process for a number of weeks. Where the majority of the data gathering exercises at management level where the focus was on gathering the outline business processes and the perceived detail of the IT in support of them, had taken a maximum of forty minutes, the production managers process mapping exercise took over four and a half hours. The gathering of this information was a learning exercise in how difficult it is for some individuals to express their tacitly held knowledge. The production manager freely expressed his reluctance to undertake this process as he knew how difficult he was going to find it. The board of directors had put him under pressure to deliver his process maps in support of the business process re-engineering exercise which was underway with an external agency. The knowledge that was held by the production manager was very detailed he found it difficult to model a simple representation of his processes. When the production manager was 'stuck for words' it became necessary for him walk to the shop floor and look at what was happening and to explain it by demonstration, we would return to the mapping process until the words dried up again, then back to the shop floor for another demonstration. This difficulty in expressing the models on which the process mapping was built had been apparent in all of the organisations that were studied. This problem had not been encountered at such an important stage of the process, but few of the other organisations were as complex in their production. This organisation had a large range of specialised products each with a specific and expert production system that added to the complexity of the modelling process. The company employees showed a great range of flexibility within the production process, many key workers having experience across the full product range.

This fact influenced the development of the method as it became clear that in some areas of modelling expert and external assistance may be required. This was beyond the capacity of internal members of the organisation as in some cases a lack of organisational knowledge aided the process of modelling.

The method was well appraised at the mapping level where all of the necessary data was gathered and collated by a combination of the IT director and the inexperienced research team member. The role of the team member was to ensure the correct data was gathered from the appropriate member of staff in accordance with the task trail. This role was effectively that of a 'network' had our early but failed attempts to substantiate the method in an electronic tool been successful her role would have been substantially reduced. The loss of a member of the research team had resulted in the failure of the development of a prototype which had hindered our expectations of an automated version of the method.
In an ideal environment with a lesser pressure of work, which was admittedly unlikely within SMEs the belief was that the method would have been accessible and effective in the data gathering process at the level of the task trail.

The output from the application of the method was converted to electronic format and presented to the organisation. The board members approved the output as 'an accurate representation' of their processes and IT support and valued the information as being beneficial to their on-going business process-re-engineering exercise.

Case study company E: Conclusion

The application of the method to this organisation highlighted required revisions to both the method and the application of the method as follows:

- The initial workpacks which incorporated the gathering of data on competitive advantage based on the Miles and Snow (1978) and Connant *et al* (1990) data needed to be simplified. Most of the senior management team found them difficult to understand despite the fact that at least two of the board members of this organisation had studied at MBA level.
- The workpacks benefited from meaningful examples to guide the users in the completion of the workpacks. The initial workpacks had general examples which were difficult for some users to relate to. During the data gathering exercise the team member used previously internally completed packs to support users that were unsure, this technique improved the level of comprehension and thus the data gathered.
- Guidance in the modelling process by external experts could aid the data gathering exercise.

- The data gathering process was very time-consuming for a small organisation where pressure of work made it difficult to maintain progress. This issue required top-level commitment to data gathering if the process was to be successful.

Conclusion

This chapter has described both the methods of data gathering and the data gathered, in the three stages of the research process. In the first instance the organisation investigation relied upon a simple data gathering technique which supported the objectives of the research. These objectives were focused in terms of understanding a small organisations need to substantiate its knowledge of either its legacy systems or its business processes in terms of the impact of potential changes. The research conducted at this level informed the development of the RAMESES method which was validated against the initial corpus of data gathered in company C. The method was then tested in a further organisation to assess the ability of companies to self-assess their requirements. This user testing led to a number of revisions being made to the RAMESES method and the manner in which it could be applied in an organisation. The process modelling element which is the focus of this thesis had a fundamental contribution to the organisational assessments that were undertaken.

CHAPTER 6

Evaluation and analysis

Introduction

A central aspect of the work reported here has been in devising appropriate techniques for capturing, representing and understanding the business activities within individual SMEs and the relationship between these and their IT systems. This is of practical importance to managers in SMEs since, for instance, when a new system is needed to support a particular business activity, the interconnections between many of the existing systems and business processes can act as a constraint on the range of solutions available to the organisation.

Understanding the impact of existing and planned systems in any organisation is complex, therefore those involved in both the analysis of business processes and requirements specification of systems need a range of appropriate tools to support them in their work. This empirical research in the SME environment, since 1997, has focused on the manufacturing and distribution sectors and has shown them to have the following typical characteristics with respect to IT systems (Edwards and Mallalieu, 1999): their IT systems are business critical but they perceive IT systems as tools to support business activities; they rarely have IT departments and tend to rely on informal acquisition of IT knowledge. Therefore, for such organisations, IT systems specification, acquisition and evaluation are both important and difficult. The research undertaken within SMEs in N.E. England has shown that for such organisations current IT systems usage and future IT systems requirements can be most effectively understood when viewed from a business process perspective. This chapter presents the outcome of the work: a business process modelling technique, that has been developed and trialled within manufacturing SMEs (see chaper 5). There are many process modelling techniques available (Ould, 1995; Giaglis, 2001) two of the most popular approaches are data flow diagramming (Yourdon, 1989) and IDEF (McGowan and Bohner, 1993). However, the terminology and complexity of usage associated with these makes them inaccessible to the majority of SME personnel. Some simple techniques, based upon data flow diagramming have been proposed and used successfully within a business process context, for instance (Deeks et al, 1997; Tam et al, 2001) however, these do not support the richness of data that was required for the research focus on systems change. The technique that has been developed during this research, Business Activity Modelling (BAM) technique, requires little in the way of training, is easily understood by SME personnel and has the benefit of explicitly identifying the areas in which IT systems impinge on business activity.

Usage of BAM in practice: A case study illustration

The case study organisation discussed in this chapter was studied, in detail, over a six month period. This section focuses on those aspects relevant to business activity modelling. To put this in perspective some background is given. The company employs approximately 190 people in the manufacture and servicing of power supplies for the electronics industry. The company was concerned about the perceived failure of an Enterprise Resource Planning (ERP) implementation. The aim of the study was to determine whether user acceptance could be improved and to identify any potential enhancements that could be implemented. The major stakeholders in this project were the senior management team and a key user group. The business development manager responsible for the implementation of the system led the project as the nominated co-ordinator. The ERP system had been under incremental implementation for 18 months but had suffered from declining user morale and was still unable to fulfil some of the fundamental requirements of the project. The organisation had a good IT department, but it was experiencing difficulties in supporting the project because of problems with the system supplier's support network. The RAMESES assessment was viewed as fundamental to the future of the system, which represented a major organisational investment in the region of £360,000.

To assess the impact of the ERP system throughout the organisation, and to determine the nature of user dissatisfaction, the project team identified a boundary for investigation following the construction of macro level models. Thereafter a selection of business process models and maps were developed as an aid to understanding the 'as is' position of the organisation.

A number of BAMs were constructed for the manufacturing functions of the organisation. These revealed differences between the perceived and actual usage of the ERP system. The perception of the head of operations was that the system was used throughout the manufacturing process. However, the results of the task trail as shown in Figure 3 indicates localised and varied software usage within the manufacturing process. Additional analysis highlighted manufacturing systems support as a key factor in the reported user dissatisfaction: this was fundamentally related to the inability of the system to support standard operating procedures. Through the task trailing it was revealed that high degree of innovative use of the ERP system and other software was enabling the business to function as required. An example of the findings is summarised in Table 1 which highlights this dissonance between reality and perception, and the impact of the new (ERP) system on production planning. The expectation was that the ERP system was being used effectively across all tasks (except production control which was expected to be carried out manually). In practice what was discovered was that there was patchy use of the system, with significant use of the office suite to develop localised software support for business activity, and two areas remaining entirely manual in operation ("labour" and "build plan" both of which were resource intensive).

	Management Perception of IT Usage versus Actual IT Usage. No of tasks supported:		
	by ERP System: Expected v actual	**by Office System: Expected v actual**	**purely manually: Expected v actual**
Forecasting	1 v 0	0 v 2	
Resource Planning	1 v 0	0 v 2	
Materials Requirement	1 v 2		
Build			
Labour	1 v 0		0 v 4
Capacity	1 v 3		
Build Plan	1 v 0		0 v 5
Production Control		0 v 2	1 v 0
Release Works Orders	1 v 1		
Reports	1v 0	0 v 1	

Table 1: Summary of IT support in production planning

In the following section the requirements and instantiation of the Business Activity Modelling BAM) technique are discussed. The usage of BAM in practice is then illustrated by focusing on some of the results from the field trials of the approach. In conclusion the main benefits of the technique and the future development of the approach are drawn out.

The business activity modelling technique

Within the research a number of existing process modelling techniques were trialled (for instance, DFDs, IDEF, RAD) since the research team were keen not to "reinvent the wheel" however, it was apparent that none of these effectively captured the range of data that was required (see chapter 2). Therefore, the requirements of the end-users (the SME staff) and the research team were examined to determine an effective modelling approach. These requirements can be analysed under three headings: Acquisition of the Business Process, presentation of the business process and analysis of the business process. These are all discussed below. Once these requirements were clearly understood the modelling technique itself was developed (as explained in chapter 5). This case study offered the opportunity to test and evaluate the RAMESES BAM method.

The requirements for the technique

The technique, "Business Activity Modelling (BAM)" has evolved in response to three main requirements in an SME environment: acquisition, presentation and analysis of the business process.

Acquisition of the business process

The main requirements in determining the type of process modelling that was required were the need to: (i) model the managers' perception of the business activity at a macro level, (ii) determine in detail the specific tasks undertaken within each business activity (micro level), (iii) map onto the business processes the tasks that are supported by IT systems and (iv) provide an approach that is accessible to all levels of employees within SMEs.

In addition to these requirements there were constraints imposed by the SME environment itself. For instance, managers in SMEs are (generally) unwilling to invest time in training personnel to use conventional process modelling techniques since the adage "time is money" is foremost in their minds. Therefore, any process modelling technique that needs to be used throughout an SME (rather than by a few specialists) needs to be readily accessible with the minimum of training and support. Moreover, all employees hold a combination of tacit and explicit knowledge about their job. They are aware of what they need to receive to carry out their allotted tasks and what they do with the result upon completion. In practice, staff in SMEs readily know both the "reporting-to" and "responsibility for" structures and the individual task inputs and outputs of their activities. Staff are also aware (to some extent) of their role in relation to the overall business process and know explicitly the software they use in support of their tasks. These requirements and constraints hold the key to the development of an appropriate modelling technique.

Presentation of the business process

Even simple diagrams become cluttered when they are used to demonstrate the business activities within an organisation. There are two main features that can be used to overcome this problem: hierarchies and layers. Hierarchies are traditionally used in process modelling. The provision of a hierarchy within the modelling approach allows the user to both look at an overview of a business process (to gain an understanding of its overall topology) and then to focus on individual elements (to drill down to their pertinent details). Layers in the process model are akin to the layers used in geographical mapping, where basic maps can have features added, or removed dependent, on the requirements of the viewer (for instance, contours, roads, places of interest). In the case of the process maps in RAMESES these layers refer to system usage, and staff skill, for instance.

Analysis of the business process

The analysis of the business process is inherently bound up with the presentation of the data. To have a thorough understanding of the process it is necessary to have access to organisational data (the "layers") so that the process can be examined as appropriate.

The instantiation of the technique

This section reflects the three requirements for a business process model identified above and provides an explanation of how each requirement is fulfilled.

Acquisition of the business process

The users of the technique complete a number of simple workpacks so that the required details can be gathered to enable the construction of the process models. There are two sets of workpacks: one which gathers the macro level data ("organisational mapping"), the other gathers the micro level data ("task trail").

At the macro level in the organisation an individual (with sufficient authority) is designated to be the co-ordinator who oversees the data collection required. S/he then liaises with the senior managers to acquire details of their area(s) of responsibility along with who they report to. A senior manager may have more than one area of responsibility and therefore may be entered several times in the workpack (as shown in the Figure 1 below). The senior managers then complete workpacks for each of their areas of responsibility. Each of these identifies: the business activities within the area, who has responsibility for each, and to whom they report. This allows the depth and breadth of the management hierarchy to be identified. Typically within an SME an individual may have responsibility for more than one activity and therefore may be entered several times in the workpack table. Where there is interest in the IT supporting the business then this is also recorded against the activity. This is illustrated in Figure 1.

Senior Manager	Area of Responsibility	Reports To:
Germaine English	Sales	Jo German
Germaine English	Marketing	Jo German
...		

Senior Manager Name: Germaine English		Area of Responsibility: Sales	
Activity	IT support	Staff Member with responsibility:	Staff Member Reports To:
Quotation for Customer	PerfectQuotes	Samantha Scott	Sebastian Walsh
Technical support	SuperCAD	Terry French	Samantha Scott
...			

Figure 1: Example of data entry for macro level data (for reporting structure)

This data acquisition approach reflects the managers' understanding of the organisation's activities, the software in use and its impact. From this, the macro business activity model is constructed. This is done simply by following the "reporting to" paths to establish the unique organisational hierarchy. Where an individual has multiple roles these are used as secondary data to ensure the correct pathway is established. The subsection *"presentation of the business process"* shows how these models are represented diagrammatically.

The nominated co-ordinator defines the boundary of the enquiry from the macro level model. Then, for each activity within the boundary (at the micro level), the staff member with responsibility is required to: identify the business processes within his/her area, list the staff members active within these processes, and mark the initial task within each process. At this stage the modelling moves away from organisational hierarchies (and functional areas) to an analysis with a processual focus and the task trailing of a process can begin. This is a critical feature of the approach, much of the analysis that can be done to evaluate the organisation and its reliance on IT systems is dependent on the information collected here. The micro level business activity model requires individual task data to be recorded on the relevant workpack. This data includes: the inputs to the task, the description of the task, and the outputs of the task. Additional information is also collected so that a profile can be constructed of: how the input and output data are provided, by whom, and whether any IT is used to support the task. In this way the business process can be built from its task level components reflecting operational practice. Figure 2 shows sample data for a business process and some detailed data from the subsequent task trail.

Business Process Component Name	Customer Order Placement
Named Staff with overall responsibility for the component	Sebastian Welsh

Task	First Task	Employee's Name
Receive Customer Enquiries	✓	Samantha Scott
Quotations		Samantha Scott
Costing		Sebastian Welsh
Customer service		Samantha Scott
...		

Process Name:	**Customer Enquiries**

Task No.:	CE1	**Task name:**	Quotations

Task Input:	Customer enquiry details
Task description:	Assess and price job details to produce quotation
Task output:	Customer quotation
Input description:	Completed customer enquiry form
Input from:	
Person	Samantha Scott
Role	Customer Service Representative
Department	Sales

Input Received Is Generated: ☐ Electronically ☐ Manually ✓

Output sent to:	
Person:	Sebastian Welsh
Role:	Sales Manager
Department:	Sales

Output Is Produced: ☐ Electronically ☑ Manually ☐

Figure 2: Example Personnel and Tasks within a Business Process, and Subsequent Task Data

The macro and micro level data sets contain the primary data for the construction of business activity models. The secondary data collected at the micro level provide additional richness in understanding the problem domain. This data includes: individual evaluations of the IT systems in support of tasks, users IT education, experience, and training.

Presentation of the business process

The textual data is transformed into diagrammatic business activity models to enable managers to view, discuss and analyse their processes more effectively. The notation used for this is similar to many other process modelling techniques:

- annotated boxes represent business activities and tasks,
- annotated arrows indicate the type of data flowing and the sequence of tasks.

Hierarchical views are developed where appropriate so that the business activity can be broken down until "atomic" tasks are achieved. Where the technique diverges from the norm is in the use of additional information to enhance and enrich understanding. For instance, layers of colour show IT systems impact within processes and numbers of users are recorded against these IT systems as an indication of the degree of usage. Figure 3 shows an example of a **partial** business activity at the model micro level. This example shows the "IT systems impact" layer (on this figure the "colours" are replaced by shaded boxes). It is worth noting at this point that, unlike this small scale example, the task trails are typically processual in nature and define business processes that cut across existing functional boundaries. This provides a mapping of the business that is often revelatory to the organisation.

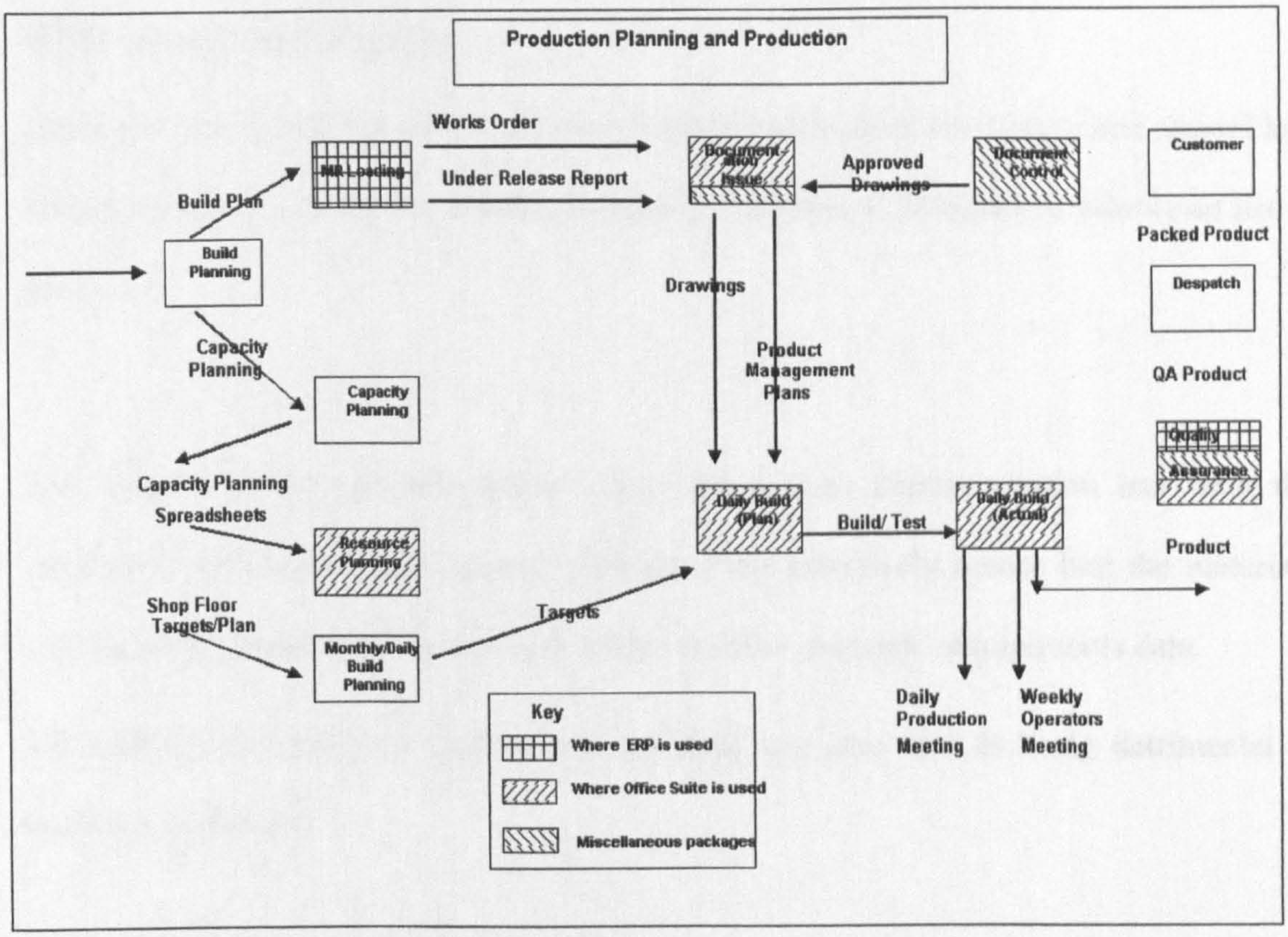

Figure 3: Partial task trail, with IT systems usage identified

Analysis of the business process

This approach results in a variety of business activity models: each is a representation of a different view of organisational data. The analysis of this data is undertaken by comparing and contrasting pairs of representations. In our fieldwork the most common sets of comparisons were:

- The current situation: perception versus reality.
- Macro level versus micro level.
- Effectiveness of current business operations: for instance, identification of bottlenecks.
- Employee analysis: for instance assessment of workload.
- Employee analysis: secondary factors emerging from the layer analysis, including skills profile, potential champions of change.
- Effectiveness of IT Systems support across process and within functions.

ERP: needs and training

The majority of users had additional comments to make about the system and several key themes from this section are detailed in future work below, alongside a prioritised list of needs.

The factor with the greatest impact upon the system implementation has been the inability to solve the 'backflushing' problem. This effectively means that the materials requirements system ERP is currently unable to offer materials requirements data.

The inability to create and handle report writing was also seen as being detrimental to system contribution.

Several issues were raised which relate to user confidence; they were that some of the system data is inaccurate due to a lack of system discipline and the importation of poor quality data from the previous system. The system was also seen to lack relevant job specific documentation in terms of usage. It was identified that a lack of system training had contributed to these factors. Some users expressed a concern that substantial amounts of work were being undertaken in supplementary packages e.g. Excel, Access, to work around some of the problems highlighted above.

The user group generally expressed the fact that the system failed to fulfil potential that they could identify.

Training needs

The training needs identified through the user survey have been categorised both by general and by specific departmental needs. The need for training is currently recognised within the company and a structured approach to training through expert –led workshops has been implemented. In the table below the appropriate training activity has been linked to the identified training need. ERP training has been identified from four perspectives

- Basic system orientation training
- Process activity training
- Procedure training
- Specific technical training

General user needs

This section shows the common needs that have been highlighted throughout the various departments within the organisation.

Training Need	**Action**
Users require more training on the system - There is a common feeling that the ERP has potential, however because of their lack of familiarity with the system they are unable to utilise this potential.	Basic system orientation training. This is required to give users an understanding of their place and role within the system. It also reinforces the need for good system etiquette and aids identification of future usage
Training is desired by several employees within the company in regard to report writing - some personnel have mentioned that the system lacks the standard required reports.	Process activity training Specific technical training Users would develop report requirements via Process training with the production requiring technical expertise

Training is desired by several employees with regard to how other users inputs affects the following person within that process, mistakes on bills of materials (BOM) and aspects of Accounts for example, can cause problems for the receiver of this incorrect information.	Procedure training. At this level training would develop system etiquette which emphasises the need for data accuracy…'garbage in garbage out' ethos
The system lacks basic instructions, most departments are writing their own procedures.	Procedure training. A combination of procedure training and use of the on-screen help files would give effective training support to users both of system usage and company procedure

Section 2

Problems specific to major departments

This section highlights the problems with ERP that are relevant to the main departments.

Production Department

Training Need	Action
Job based training would be useful.	Procedure training
Advanced Planner System training is required.	Process activity training
Training/help required in the area of Traceability set-up.	Procedure training

ICT Department

Training Need	Action
Training in the area of workflow required.	Basic system orientation training
Training in the Optio, the electronically printed stationary, The company has no personnel with skills on how to use the Optio system.	Specific technical training

Quality Department

Training Need	Action
Quality department need basic training on functionality aspects of the system.	Basic system orientation training
Training required as MRB do not know how to obtain information on the defects or if the system can do sub-assemblies.	Process activity training

Goods-In Inspection

Training Need	Action
There is a need for clear navigation. Trying to find exactly what you need, when you do not know where it is.	Basic system orientation training

Design Department

Training Need	Action
System in general needs attention. It does not fulfil	Basic system orientation training

basic design requirements.	Process activity training

System needs

From the research the following system needs have been identified. They have been categorised according to the type of action required to deal with them. These are

- System modification
- Extensive programming requirement (external budget over £1500)
- Limited programming requirement (external budget under £1500)
- Internal capability to execute change
- Available within the system but not yet implemented (resource deficiency)
- System bug (repairable through upgrade)
- Changes enacted through procedural training
- Not Possible

General user needs

This section shows the common needs that have been highlighted throughout the various departments within the organisation. The type of action required for rectification has been displayed alongside the original system specification where appropriate.

User Needs	Action	System Specification
The "Back-flushing" function is a necessity for most major departments - The inability of the system to deal with this function has caused problems and	Type 3 Changes which can be achieved via 9.1.7 upgrade. Implementation should be complete by 30/9/2000.	Marked on plan as critical (see system spec no. 16)

misgivings toward the system.		
Company/Vendor relationship needs improving. Many users reported the fact that they were dissatisfied with the level of support and commitment with regard to vendor support.	This problem may be improved through a change of personnel at the communication level from both sides.	See schedule F in system specification relating to response times. Users reported waiting 'weeks' for responses to some queries
The system lacks basic instructions, most departments are writing their own procedures.	Type 4 Changes enacted through training	See schedule C (implementation support schedule) 81 days allocated
Many users feel that the screens hold too much detail -very comprehensive. Users also feel they have to go through many different screens to find the one that they want.	Type 3 Changes which cannot be assessed until after the 9.1.7 upgrade. Screen tailoring may affect future maintenance issues	
Process of creating the part number is too long and cumbersome. It can also lead to double entry of part numbers through the long part number creation process.	Type 4 Workflow training may resolve this issue	

A large number of specific user needs were also identified through the data gathering exercise (see appendix 4). These issues were in response to an evaluation of the system implementation against the specification document. It was apparent that many of the issues initially marked as critical had not been resolved by the system implementation. These issues were a fundamental aspect of the levels of user dissatisfaction with the system, in that they had specifically requested solutions to problems that existed, had been assured of their solution within the remit of the implementation which had in fact failed in these aspects of application.

System impact analysis

This section contains detailed mappings of top-level and procedural level business processes. The maps have been analysed to identify the impact of ERP on business processes for a perceptual and actual perspective. The degree of workaround has also been accounted for. The accuracy of this information is compromised by the lack of consensual information as to the understanding of business processes which exist amongst the workforce. This data could be utilised in further developing understanding and has been included for that reason (See appendix 3 for mappings).

Business Process	ERP coverage	Top-level coverage	Degree of Workaround	Variance top/ procedure levels
Customer Order Placement	22%	0%	78%	22%
Design	0%	0%	100%	0%
Sales	10%	0%	90%	10%
Quotation	0%	0%	100%	0%
Traded	8%	0%	92%	8%
Design for manufacture	23%	45%	77%	22%
Manufacturing	60%	60%	40%	0%
Materials	50%	50%	50%	0%
Quality	8%	10%	92%	2%
Service	31%	100%	69%	69%
Accounts	56%	56%	44%	0%
Production Planning and production	17%	14%	83%	3%

Project pluses

This project seems to have been well managed in the initial stages of specification and requirements analysis. The incremental approach to implementation has enabled the development of a widening and increasingly effective user base.

- The Learning centre within the company is perceived as being a training centre for new recruits. The development of lifelong learning as a concept has not been effectively transferred.
- The ERP project has suffered from a lack of top-level management intervention. This issue has impacted upon the project outcome, as the priority allocated to time and resource availability was insufficient for the scale of the implementation.
- Widening the adoption of ERP could be directed from the executive committee. Although some aspects of the business have identified that ERP does not fulfil their requirements (e.g. sales) further implementation could be undertaken with the adoption of alternative working practices.
- Dealing with human resource issues in terms of the relationships between key staff involved in the project could improve moral and restart motivation.
- This system implementation has been conducted in an evolutionary manner. The current state of the project is realistic, although perhaps a little slow. Further implementation will proceed as needs are identified.

Conclusion

Business activity maps and tasks trails provides SMEs with an approach to process modelling that can be adopted without the need for extensive training. In practice the research team have used the approach in five organisations, co-ordinated its usage in another two and provided initial training for co-ordinators who have independently applied the process in another three companies. The feedback from this usage has revealed that the critical components in its successful application are:

- The use of one trained co-ordinator: this training has been carried out by the researchers within a one-hour session and followed up with (limited) advice in the early stages of the application of the approach.
- A "top down" approach: to allow the co-ordinator to gather the data at the macro levels from the appropriate managers and use this to set the bounds for the micro level data collection.
- Access to the management team: so that the co-ordinator can distribute the workpacks for the data collection.
- Access to the personnel within the boundary of investigation: so that the co-ordinator can distribute the workpacks for the data collection.
- Analysis of the resultant data by either the co-ordinator or a small group to draft the process models and undertake the analysis of the layers. For this to be done accurately the time needs to be made available by the organisation for this activity.

The components highlighted above indicate a "top-down" sequential approach. However, it was found in practice that the data gathering could be undertaken in a piece-meal fashion. With the proviso that the co-ordinator manages the process carefully and is aware of "missing components". This enables the maps to be created and enhanced as the data becomes available: in this way gaps and inconsistencies are demonstrated and the co-ordinator can ensure that either the required data is then collected, or highlights to management a breakdown in a process in the organisation. Practice has shown that the maps and models are frequently developed in this iterative manner.

The two main advantages of the BAM technique are its accessibility to non-technical staff in SMEs, and the flexibility that the technique offers in enabling managers to evaluate and appraise their business processes from a range of perspectives: for instance, effectiveness, staff skills/competencies, software support. The technique is currently one component within the RAMESES method and has partial software support. However, the next stage of development of the technique is to provide a fully functional software tool to support the users throughout the mapping/modelling process and to trial the approach within a wider range of companies. Without software support for the technique organisations are unlikely to make full use of the data collected since, although the maps can be manually constructed quite simply, the addition of layers of supplementary data that can be superimposed or reviewed in associated reports and charts would be time-consuming when collated manually.

This chapter has identified the case study in which the RAMESES BAM method was applied. A detailed description of the BAM method was given and illustrated by examples from the case material. Additional material has been included in order to explore the type of data which can be collated by application of the data gathering method. The chapter concludes with the results of the investigation and with suggestions for the further development of the method.

CHAPTER 7

Conclusion and future work

Introduction

This chapter reviews the thesis with the purpose of presenting the conclusions of the research and outlining the direction of future work. The conclusions are delivered in three sections, firstly relating to the SME and the appropriateness of the BAM technique developed within the RAMESES project. Secondly conclusions are drawn in regard to the research methodology and reflections shared as to the efficacy of the process. Thirdly reflections and conclusions are presented that relate to the work in relation to its overall critical aims and by locating the thesis contribution to the knowledge bases in the fields of information systems and academia The chapter concludes with suggestions as to the direction of future work.

Chapter 1 sets out the overall problem domain in which this thesis is situated describing the 'wicked problem' and its impact on the investigation of change to system or process for the SME. In chapter 2 the literature pertaining to a critical approach to small organisations and business process modelling was reviewed in order to set the context for the study. The research framework was analysed in chapter 3 giving the outline for evaluation of the research, whilst chapter 4 reviewed the research approach. The research activity was detailed in chapter 5 drawing on the case material from the participating SMEs and described the method which was developed. Chapter 6 evaluated the BAM technique for efficacy against a further case study.

Conclusion of the research

For the non-IT specialist small organisation IT is a complicated, and to some extent, inaccessible world. The information society insists ever more pressingly that organisations are 'connected' with a global informatics presence: and can interact with both customers and suppliers in an increasingly electronic manner. Within small organisations the pressure to upgrade and conform is constant but the lack of resources, often combined with a lack of professional IT expertise, make it difficult to effectively comply. An informed internal approach is one of the suggested ways forward for small organisations to improve this situation. Understanding the system *in situ*, where organisations endeavour to have a thorough knowledge of their IT legacy, offers a route by which they are better informed within the decision making process. This in-depth knowledge enables improvements to the process of specifying requirements when system changes are under consideration. The RAMESES method involves the development of such a corporate knowledge base from which information can be drawn when required.

An additional means of system improvement is through the development of trusted partnership agreements with system suppliers. Using suppliers who, over time, develop an understanding of the organisation can avoid the sort of costly mistakes which occur through a lack of domain knowledge. This is a useful approach especially for the successful implementation of specific COTS or bespoke developments. Here the software house has understanding of the IT industry and the future trends which need to be accounted for within the decision making process. An evolutionary step from the perspective of a supplier may appear to be a radical paradigm shift from the organisation's viewpoint. The successful integration of COTS into an organisational portfolio can also be aided by involvement with external user groups. External user groups enable the establishment of user power bases: which can restore equilibrium between supplier and user.

One small organisation has little room to negotiate with a larger software supplier, but an effective user group may influence change on behalf of the group.

Within this thesis the legacy issue as it relates to the case studies and their systems has been described. There is nothing generic about the specific case study material, which has been presented. This material is merely 'interesting'. Yet, still may raise awareness, within the discipline, of factors that affect small organisations. Even in organisations that lack the benefit of in-house IT expertise the discipline of software maintenance can offer guidance leading to legacy system improvement, if the information is presented in a coherent and accessible format. For, it is an organisation's ability to consider the outcomes of previous systems decisions that enable better-informed choices to be made in the future. One of the aims of the RAMESES method is to provide the means by which an organisation can store and easily retrieve information relating to past decisions and to incorporate that learning experience into future actions. The organisations are given a route map to:-

- Audit all IT system information including hardware, software, communications and the current levels of user training.
- Log all business processes relating to changes, with an audit of role activity and supporting IT.
- Categorise the organisation in terms of its culture.

This combined information is used to assess the areas of impact of proposed changes. The effectiveness of changes made in such an informed manner can be assessed over time giving hindsight a chance to inform the future: you can't see into the future, but you can reflect on the past.

At the start of the RAMESES project, it was not known which factors would prove relevant to the relationship between an organisation, its business processes and its IT. In that sense, the problem was not well defined. However, it was known that the solution, which was the aim of the project, was to provide a tool which would allow Small-to-Medium sized enterprises (or consultants working with them) to perform their own assessment of the risk involved in changing either a business process or a legacy IT system. They would have to get to know themselves in just the same way as understanding the case study companies evolved through time and familiarity for the researcher. The ways in which the method directed and supported self-assessment and the questions it suggest they ask themselves are directly derived from the factors which assumed significance during the case studies. This is then a very clear case of interaction between solution and problem as advocated by the wicked problem literature (Rittel & Webber, 1973). The notion of assessing risk allowed a focus on the problem, whilst the mechanism of a method by which enterprises could assess themselves led to the emergence of such factors.

Viewpoints on an organisation

An organisation may be examined from an infinite number of viewpoints, but where the researchers stand is determined by what they are looking for. In observing, interviewing and mapping, the researcher has always to consider that the questions are **about** something. This "aboutness" is a viewpoint. Grounded theory advocates a very open and inductive style, but each study must have its focuses, its "abouts" and its viewpoints. The viewpoints selected were chosen to reveal the parallax and the gaps between business processes, IT processes, and the usage of both, because a gap was taken to represent a risk. As the research focus was on risk, the chosen perspective was honed to identify gaps, inconsistencies and failings where such risks may lie. To the furtherment of the aims, the solution space determined the problem space that was under consideration. Had such a purposeful approach to the project not been taken, such a wide ramification may have prevented analysis from being concluded. Instead, the investigations have been undertaken with a consistent and useful perspective, and a highly usable method has evolved.

The software engineering community is becoming increasingly aware of the need for suitable methods and practices to aid the acquisition, integration and maintenance of CBS. The ever increasing use of shrink-wrapped software within organisations has to a large extent led the requirements for such study. Although this is seen as a relatively new arena within large organisations it has long been the case for its smaller counterparts. For small organisations the world of IT has long been a site fraught with costly problems. The RAMESES project aimed to disentangle some of the complexities of IT systems in this environment. The aim was to offer practical help to non-IT specialist organisations with little or no formally trained IT staff. Understanding the world of IT is essential in today's ever increasingly global electronic market place. Another key factor for such organisations is the need to explicitly collect the information which embodies their organisational knowledge. The adoption of the RAMESES method offers an effective mechanism for collecting, storing and retrieving the context specific data that enables a meaningful understanding of organisational systems.

The sites within this research project consist of small organisations specifying system or business process changes. The constraints which impact most heavily on these organisations are the time in which the specification must take place and a lack of in-house expertise upon which to draw. The case study material has been used to extract the type of information which would be elicited from a more formal process. This data has exposed a wide variety of issues which would be readily available to an experienced requirements engineer, but are perhaps more elusive for the more generally qualified staff of an SME.

The need to collect information for the purposes of requirements engineering from a variety of perspectives is not a new concept. The RAMESES method aims to encapsulate this view of multiple perspective data collation in an accessible format for smaller organisations. The objective is to collate a series of images of the organisation and by a process of cross-referencing and filtering, to develop an organisational profile which will inform the change process. The risk of change for organisations will be minimised with a combination of realistic goal setting and a comprehensive understanding of the current situation.

As organisations become more mature in their use of systems, their ability to capture requirements grows. RAMESES can aid this process as it offers a structure under which 'young' organisations (in terms of system development) are able to capture requirements which may be beyond their current state of maturity. The method instils the 'replicability' of process by the imposition of a structure for the collection of the complex plethora of information required for the purpose of holistic system understanding. The issue of organisational maturity and improvement is a feature which commands much attention within the current research climate. The quest for competitive, efficient, and streamlined organisations crosses the divide of large and small, service or manufacturing companies, and has led to the development of tools, techniques and approaches which service this need. The techniques afforded by the RAMESES method offer such benefits to organisations which have previously lacked the technical skill to benefit from these developments. The focus of RAMESES was therefore to offer **accessible** and **appropriate** decision support for meaningful action within the framework of the small 'learning' organisation, the key for which was the ability to represent and understand the business processes and the software which performed in support of their business activity. The BAM modelling approach fulfils the initial requirements that emerged from the investigation of the participating companies and has been successfully evaluated in such an environment.

Conclusions referring to the research conducted

The SME domain offers an interesting and valuable arena of investigation, this section will consider the trials and tribulations of such investigations. Within the RAMESES project we were fortunate to have access to a number of interested companies, the initial investigations taught us that their expectations of the research were very different from those of the researcher. Several of the companies thought they would be participating in a project that would furnish them with a new computer system, not a method to help identify their requirements and understand their business processes so that they could assess risk of change. It was an important aspect of the research process to manage and change these expectations in order to avoid disappointment in the organisations. This was achieved through constant reiteration of the research objectives and an active approach to inclusion of the organisational actors within the decision making process relating to the direction of the research. This was an effective strategy as further research projects were undertaken within the companies after the conclusion of RAMESES.

A key problem within the research process was the instability of the organisational arena, this was difficult to account for and unpredictable in its effects. In the first phase of the research during the investigation of companies A, B, and C a situation developed that impacted upon the research project. Company B had undertaken a benchmarking exercise in conjunction with the CBI and supported by the DTI. This initiative led to the withdrawal of company B from the research project. At this stage the researcher had collected data on the organisation, undertaken the IT audit, and had begun to map the business processes. It was interesting to reflect on the withdrawal of the organisation from the research project, as the withdrawal was instigated by the consultancy which was involved in a 'lean manufacturing' initiative. It seemed to the researcher that lean manufacturing offered little to a 'job shop' manufacturer, who produced to order, high value, low quantity, specialist products. The company remained in contact with the research team and asked for assistance some eighteen months later when the initiative was deemed to have failed. A further difficulty was encountered when company A was bought into a consortium which had the effect of imposing group IT support which made it impossible to undertake any type of 'before' and 'after' analysis which had been included in the initial work plan.

Internal problems were also encountered within the project, the initial project proposal identified the need for a software tool to be developed which would support the method of risk assessment. A major aspect of the tool was the need to support the BAM technique. A high level of project resources were directed towards the development of the tool which was unsuccessful. Such resources may have better deployed away from the development of software. Software development is a complex and time consuming process and success proved difficult to achieve. This is a difficulty of computing research where the ability to attract high quality software developers is difficult as wages are not commensurable with those in industry.

Research activity conducted in such a dynamic domain needs to remain flexible and fluid to adapt to environmental changes both internal and external. The researcher needs constantly to be alert to developing and changing situations and reviewing the potential paths for the progression of the research is imperative.

The multi-disciplinary nature of the research team also gave cause for reflection, a number of issues emerged during the research process which merit further discussion. Initial meetings within the team were often heated as the themes under discussion were debated with an objective of making decisions. A number of words and phrases became stumbling blocks as the different communities of practice tried to develop consensus of the meanings of the articles under discussion. The term 'business process' was a particularly difficult term to agree upon, with many definitions contributing to the finally agreed term some six months later.

The impact of the disparate nature of the research team was experienced at a more fundamental level than that described above and its impact on discussion. A philosophical dichotomy existed which was complex to explore and is apparent in the body of this thesis. The researcher, as sociologist, came from an interpretevist background, recognising the need for the inclusion of the notion relating to the primacy of the user within the contexts being explored. Conceptually this focus was at variance with the logical empiricist background of the principle investigator who was a software engineer. The style of the method developed reflected the engineering paradigm but was conducted in a more interpretivist manner than may be suggested by the final outcomes. This was a lesson in the adoption of a critical perspective where the combination of qualitative and quantitative methods have combined to enhance understanding of the research domain, process and of those involved. This however, can be influenced considerably by the power relations that exist within the research domain. The power relations impacting upon the representation of the RAMESES work, considered the primacy of the engineering paradigm within the research project, from both an internal and external perspective. The research community in which the project was situated consisted mainly of members strongly of the logical empiricist school of thought. The validity of our 'softer' work was challenged as being aligned within the aims of such a community. This affected the style in which the work was presented and the manner in which the material was developed.

The emancipatory element of the project related to the role of the small organisation in society as a whole, it that it was noted by the Technology foresight Panels (1995) that SMEs represent a significant proportion of the economy and are critical to the future expansion of the manufacturing base.

Conclusion from the research findings

Soft Systems Methodology suggests a greater support for the sense making process in analysis activities. Significant emphasis from the information technology industry is put on project management skills ('strong leadership') and requirements engineering, which by default has a strong relationship with structured systems approaches and formal methods (e.g. Anon, 2000, Menzies *et al* 1999). A traditional and heavy reliance on mathematical and formal methods is less than convincing where such a description does not equal experienced characteristics of the majority of computing activities (e.g. Mahogany & Van Tone, 1990). The lack of reliance in practice on formal methods also has parallels in relation to characteristics and experiences from activities related to organisational change, information systems analysis and development (Bednar & Wang, 1994).

This thesis acknowledges that the role of the researcher and the represented inquiry is determined by the inquirer's interests and background beliefs, as well as by the questions asked. It is suggested that it should be seen as possible to explore possibilities for a broadening of the interpretative framework in use. Such a broadening activity could be explored through a systemic and reflective sense-making learning process. This kind of understanding of both practice and theory could provide a more robust place for researchers activities, information systems deployment and research.

Within the research project, assumptions were made in relation to organisational strategy, planning and approaches to information system. Tried and tested measurements from organisation studies were adopted and implemented within the RAMESES method. For example, the Miles and Snow (1978) model for competitive advantage was used to ascertain the degree of stakeholder consensus, in relation to the type of organisation that the stakeholders perceived they belonged to. The data collected across the organisations studied revealed interesting insights into:-

- the research activity
- individual organisations
- communities of practice

The research team, from experience of previous research, expected (for example) to discover a correlation between the stakeholders within individual companies, with smaller companies showing a higher correlation of consensus in the Miles and Snow (1978) model. The most consistent factor to emerge was the diversity of perception of organisational strategy within the organisations. When this data set was compared across organisations however, correlation existed according to the role of the stakeholder. Managing directors and sales executives considered the organisations to be pro-active whilst the production managers saw the organisations as being reactive. Within the engineering organisations under study, the issues surrounding communities of practice to which the stakeholder belonged appeared to add greater strength to the perception of organisational approach than the actual practice (as observed by the researchers) within the organisation. As the nature of this project is characterised by organisational inquiries and qualitatively focused in-depth analysis, the data set collected is not statistically significant, although it could suggest areas for further large-scale investigation.

The identification of communities of practice was born out by further analysis of the empirical material. One example was studies of the process flow maps which had been simply constructed in co-operation between the researcher and the individual stakeholders. The style and appearance of this data also showed a correlation between stakeholder roles. The senior engineers within the different organisations constructed consistent hierarchically ordered representations of the process under study. Commercial managers consistently developed representations, which appeared disordered and complex. This dichotomy, which was observable across organisations when reflected upon by the researchers, gave insight into operational procedures. The senior management teams within the four engineering organisations seemed to have what could be described as a traditional husband and wife type relationship. Where the focused engineer related a simplistic well-ordered representation of work, that was made possible by the multi-tasking complex support role of the commercial manager. This correlated to Handy (1992) and a classic type relationship. Here partners had distinct roles, one focused and thrusting, the other supportive and caring. By taking care of the details of everyday commercial life managers freed the engineers to achieve manufacturing success. The research results suggest the need for the information system analyst to instigate and acknowledge the context of the user, and to incorporate the notion of multiple view-points into the design and implementation process. This is supported by the RAMESES method.

The simplistic method of mapping process within the organisations was developed as a means of trying to avoid multiple levels of reinterpretation within the data set. Data was collected from individual users explaining their everyday descriptions of their work. These separate data items were then used to construct diagrams in a consistent manner regardless of the community of practice that the user belonged to. This enabled a degree of democracy within the mapping process with an equal voice being given to all. Discrete data items could then be used to assemble diagrams of different types according to the purpose of analysis. Discrepancies between the understanding of co-workers as to who did what are identifiable and able to be reflected upon in order to make actual practice representable.

Contribution to knowledge

This thesis offers a contribution to knowledge in three key areas:

Curran and Blackburn (2001) argue that a requirement exists for research within the field of SMEs that contributes both to the practical body of knowledge that surrounds the SME and that this research in addition should propose theory and method in support of such findings. The BAM method has been developed from an empirical investigation of the case studies involved and therefore supports both aspects of Curran and Blackburn's case. The research has practically raised awareness of the relationship between SMEs and the IT systems which support their organisations and offers a method by which their internal understanding of such a relationship may be improved.

Waring, Bryans and Mavin (2003) have identified the strong position of positivist research in the management field, this thesis may contribute to knowledge in the exploration of the dichotomy which exists between the interpretivist and logical empiricist paradigms which have both contributed to the research project. The role of method in the discipline of software engineering has an impact which is as essential in the development of business critical systems as it is in the development of a bridge. By incorporating the interpretivist approaches to enable an increase in understanding the role of context in the application of method, a highly usable tool has been developed. This empirical application of a critical approach supports the contention of Lyytinen (1992), that further practical studies are required in the information systems field in order to develop further methodologies and understanding of how such projects may be conducted.

The third area of contribution relates to the field of organisational learning, SMEs are a domain which have been identified by Pye (2002) has having difficulty specifying their needs in terms of training which they see as fraught with difficulties in terms of its applicability to business needs and the cultural difference between trainers and users. The RAMESES method can offer a route to improvement in this area in that where SMEs better understand their current state in terms of skills and systems they are better able to articulate their specific needs.

Future work

The technique is currently one component within the RAMESES method and has partial software support. However, the next stage of development of the technique is to provide a fully functional software tool to support the users throughout the mapping/modelling process and to trial the approach within a wider range of companies. Without software support for the technique organisations are unlikely to make full use of the data collected since, although the maps can be manually constructed quite simply, the addition of layers of supplementary data that can be superimposed or reviewed in associated reports and charts is time-consuming. Interest in this method has been expressed by UKonline who are charged with improving the E-business economy within the UK. They have identified the possible contribution of this method in raising the standard of SMEs in line with government directives to support a number of initiatives, including business integration, and Investors in People (DTI 2002).

Within the domain of large organisations, resources such as time, money and expertise are often available in-house or are brought in for specific projects. This ensures that the organisation has access to the best requirements engineering process which can be achieved relative to their maturity: for instance as measured against the capability maturity model [8]. For small organisations however, the picture is quite different. Their ability to specify a new system, or an enhancement to an existing one, is fraught with difficulties. The key to this failing is that few such organisations have technical systems expertise in-house. The understanding of where technology can aid the organisational process may well be out of date, flawed or simply unrealistic. Within the RAMESES project the fieldwork conducted supports this view. However the consultants who offer support to SMEs are mostly business analysts who offer known solutions based on a specific approach to organisational change such as 'lean manufacturing' regardless to the specific needs of the small organisation. To redress this issue the RAMESES method brings together:-

a) the perspective of the requirements engineer which provides

- the benefits of a structured approach to the collection of data
- up-to date information about system developments and opportunities

b) the perspective of the business analyst which provides

- the understanding of organisational issues
- an up to date review of current business processes and existing systems

Future directions could incorporate these perspectives to aid the development of organisational learning initiatives by understanding more fully the relationship between the professional systems and business experts and the uniquely situated SME.

A third area of future work is located within the arena of the intelligent agent, assessing the appropriateness of agents to operate as an intermediary and reduce the impact of the data collection process within SMEs is an opportunity currently understudy.

Finally, a future direction to the BAM method could be to incorporate a narrative element which would support organisational learning through the development of user stories of 'how to do the job'. Such stories can highlight the specific trials and tribulations surrounding practice and may offer a route by which understanding may be enhanced.

References

Adolph, W. S. (1996), "Cash Cow in the tar pit: reengineering a legacy system", IEEE Software, Vol. 13, No. 3, pp. 41-47.

Agner Sigbo G. & Ingman S. (1992). Sjalvstyre och flexibilitet - drivkrafter vid kontinuerlig systemutveckling. Uppsala, Sweden: Arbetsmiljofonden och NUTEK, Ord & Form AB.

Agner-Sigbo G. ed. (1993). Fortsattning Foljer (in Swedish). Stockholm, Sweden: Carlssons Bokforlag.

Ahmed, P.K. and Simintiras, A.C. (1996), "Conceptualizing business process re-engineering", Business Process Management Journal, Vol. 2, No. 2, pp. 73-92.

Alabastro M. S., Beckmann G., Gifford G., Massey A. P., Wallace W.A. (1995). The Use Of Visual Modelling In Designing A Manufacturing Process For Advanced Composite Structures. IEEE Transactions On Engineering Management, 42 (3), pp233-242.

Alvesson, M. and H. Willmott, (1992), "On the Idea of Emancipation in Management and Organizational Studies", Academy of Management Review (17)3.

Andersen N. E., Kensing F., Lassen M., Lundin J., Mathiassen L., Munk-Madsen A., Sörgaard P. (1990). Professional Systems Development: experiences, ideas and action. New York: Prentice-Hall.

Anon. (2000). Getting it right for government: A Review of Public Sector information technology Projects. the Computing Services and Software Association. http://www.cssa.co.uk (valid 06 Dec 2000).

Aoyama, M., (1998), New Age of Software Development: How Component-Based Software Engineering Changes the way of Software Development. Position Paper. International Workshop on Component-Based Software Engineering at 20th International Conference on Software Engineering, 25-26 April 1998, Kyoto, Japan.

Argylis, C., Putman, R. and McLean Smith, D. (1985), Action Science, San Francisco, Jossey-Bass.

Argyris C. & Schön D. A. (1996). Organisational Learning II - Theory, Method and Practice. Reading Mass: Addison Wesley.

Argyris C. (1990). Overcoming Organisational Defenses: Facilitating Organisational Learning. Englewood Cliffs, New Jersey: Prentice Hall.

Argyris C., & Schön D. A. (1978). Organisational Learning. Reading Mass: Addison Wesley.

Argyris, C. and Schön, D. A. (1991), "Participatory Action Research and action science compared: a commentary". In Whyte, W. (ed) (1991) Participatory Action Research, London, Sage.

Arnold, R. S., "Common Risks of Reengineering", Reverse Engineering Newsletters, April 1992.

Arthur, L. J., (1988), Software Evolution, New York, John Wiley and Sons.

Ashworth, C. M. (1991). Structured Systems Analysis and Design Method (SSADM). In The Software Life Cycle (pp. 168 - 188).

Auramaki, E.,Lehtinen, E., & Lyytinen, K. (1988). A Speech Act Based Office Modelling Approach. ACM Transactions on Office Information Systems, 6(2), 126 - 152.

Austin, J. L. (1962). How to do things with words. Clarendon Press.

Avison D. E. & Fitzgerald G. (1988). Information systems Development: Methodologies, Techniques and Tools, Oxford: Blackwell Scientific Publications.

Avison D. E. & Fitzgerald G. (1995). Information systems Development: Methodologies, Techniques and Tools, 2nd edition. Maidenhead, England, McGraw-Hill.

Avison, D. E. and A. T. Wood-Harper, (1990), Multiview: An Exploration in Information Systems Development, Henley on Thames, UK: Alfred Waller Ltd.

Avison, D. E., . Wood-Harper, A. T.: Information Systems Development Research: An Exploration of Ideas in Practice. The Computer Journal 34(2): 98-112 (1991).

Barrier, M. (1994), Reengineering your company, Nation's business, Volume February, pp. 16-22.

Bashein, B.J., Markus, M. L., Riley, P. (1994), PRECONDITIONS FOR BPR SUCCESS - AND HOW TO PREVENT FAILURES, Information Systems Management, Volume 11, Issue 2, pp. 7-13, CLAREMONT GRAD SCH, DEPT INFORMAT SCI,CLAREMONT,CA,.

Baskerville, R.L. and Wood-Harper, A.T. "A Critical Perspective on Action Research as a Method for Information Systems Research," Journal of Information Technology (11), 1996, pp. 235-246.

Bateson G. (1972). Steps to an Ecology of Mind. New York: Ballantine.

Bednar P. (1999). Informatics - a working chaos for individuals and organizations. The impact of the notion of information system for System Analysis and Development (in Swedish). Lund, Sweden: Dept. of Informatics, Lund University.

Bednar P. M. (2000). A Contextual Integration of Individual and Organisational Learning Perspectives as Part of information system Analysis. Journal of Informing Science. p145 - 156. Volume 3 No 3.

Bednar P., & Wang V. (1994). System Design in Practice. Empirical study, analysis and discussion of organizational issues for system design processes (in Swedish). Lund, Sweden: Dept. of Information & Computer Science, Lund University.

Bednar, P., Mallalieu, G., (2001) Romancing the Stone: play between romance and affection. EGOS 2001, Sub theme: Knowing as desire The Odyssey of Organising, 17 th Colloquium, July 5-7, Lyon France.

Beer, S., (1991) *Reflections of a Cybernetician on the Practice of Planning*; Keynote speech to the Canadian Institute of Planners to the 1987 National Conference in Toronto. Kybernetes, Vol.20, No.6, pp. 8-13.

Benbasat, I. (ed.) (1989): The Information Systems Research Challenge: Experimental Research Methods - Vol.2. Boston: Harvard University Press.

Bergner, K., Rausch, A., Sihling, M., (1998), Componentware. International Workshop on Component-Based Software Engineering at 20th International Conference on Software Engineering, 25-26 April 1998, Kyoto, Japan.

Bertalanffy L. von (1968). General Systems Theory. New York: Braziller.

Beslmuller, E. (1988). Office Modelling Based on Petri Nets. In ESPRIT 1988 Part 1, (pp. 977 - 987). North Holland.

Beyer H. & Holtzblatt K. (1998). Contextual Design: Defining Customer-Centered Systems. San Francisco, Cal: Morgan Kaufmann Publishers.

Blili, S., Raymond, L. (1993), Information technology: threats and opportunites for Small and Medium Sized Enterprises, INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT, Volume 13, pp. 439-448.

Blumer H. (1968). Symbolic Interactionism, Prentice-Hall, New York.

Boje D. M., Gephart R. P. & Thatchenkery J. T. ed. (1996). Postmodern Management and Organization Theory. Thousand Oaks, Cal: Sage Publications.

Boland Jr, R. J., (1987), "The In-Formation of Information Systems", in R. J. Boland Jr, and R. A. Hirschheim (eds.) Critical Issues In IS Research, Chichester, UK: Wiley.

Boland Jr, R. J., (1991), "Information Systems Use as a Hermeneutic Process", in H. E. Nissen, H. K. Klein, and R. Hirschheim (eds.) Information Systems Research: Contemporary Approaches and Emergent Traditions, Amsterdam: Elsevier Science, IFIP.

Booch, G. (1991). Object Oriented Design with Applications. Benjamin/Cummings Publishing Company.

Bourdieu P. (1977). Outline of a theory of Practice, trans. R. Nice, Cambridge, Cambridge University Press.

Braun, M., and Mohle, S., (1998), Developing Complex Information Systems from Standard Software Components: A Case Study within Manufacturing Resource Planning (MRP II), Thirty-first Annual Hawaii International Conference on System Sciences, (HICSS-98): Volume 6 - Organizational Systems and Technology.

Bronte-Stewart, M. and Lewis, A.R. (1997) An approach to business information technology systems consultancy. CD-ROM Proceedings of the 7th Annual BIT conference, November, Manchester Metropolitan University.

Brown, W.A., and Wallnau, K.C., (1998), The Current State of CBSE. IEEE Software, September, October 1998. Vol. 15 No 5. pp37-46.

Budgen, 1993, Software Design, Wokingham, Addison Wesley.

Burgess, T.F. (1995), "Systems and Reengineering - relating the reengineering paradigm to Systems Methodologies", Systems Practice, Vol. 8, No. 6, pp. 591-603.

Burrell, G., Morgan, G., (1979), Sociological Paradigms and Organisational Analysis, London, Heinman Books.

Cameron, J. R. (1986). An Overview of JSD. IEEE Transactions on Software Engineering, SE-12(2).

Carmel E. and Becker S. (1995). A Process Model For Packaged Software-Development. IEEE Transactions On Engineering Management, 42 (1) pp.50-61.

Cavaye A. (1996). Case study research: a multi-faceted research approach for information system, Information Systems Journal, 6, 227-242.

CCTA. (1996) SSADM 4+ Reference Manual. NCC-Blackwell, Manchester.

Champy, J. (1995), Re-engineering management, HarperCollins, London.

Checkland P. & Holwell S. (1998). Information, Systems and Information Systems - making sense of the field. Chichester: John Wiley & Sons.

Checkland P. (1981). Systems Thinking, Systems Practice. Chichester: John Wiley & Sons.

Checkland P. (1986). Systems Thinking, Systems Practice. 2:nd. ed. Chichester: John Wiley & Sons.

Checkland, P.(1991) "From framework through experience to learning: the essential nature of action research," in Information Systems Research: Contemporary Approaches and Emergent Traditions, H-E. Nissen, H.K. Klein, R.A. Hirschheim (eds.), North-Holland, Amsterdam, pp. 397-403.

Chen, P. P. (1976). The Entity-Relationship Model - Towards a Unified View of Data. ACM Transactions on Database Systems, 1(1), 9 - 36.

Chikofsky, E. and Cross, J.H., "Reverse Engineering and Design Recovery: A Taxonomy", IEEE Software, January 1990, p.13 - 17.

Chikofsky, E., "A Legacy Systems Reading List" IEEE Software, January 1995, Vol.12, No.1, p.22.

Child J. (1984). Organization: a Guide to Problems and Practice. (2:nd edition). London: Paul Chapman Publishing Ltd.

Childe, S.J., Maull, R.S. and Bennett, J.K. 1994. 'Frameworks for understanding business process re-engineering', International Journal of Operations and Production Management, 12, pp. 22-34.

Churchman C.W. (1967) "Wicked Problems". Management Science 14, pp. 141-142.

Churchman C.W. (1979). The Systems Approach and Its Enemies. New York: Basic Books.

Ciborra, C. U., and G. F. Lanzara. (1989)"Change and Formative Contexts in Information Systems Development," in H. K. Klien and K. Kumar (Editors), Systems Development for Human Progress. North Holland.

Cicouel A. (1964). Method and Measurement in Sociology, Free Press, New York.

Clark, P. A., (1972), Action Research and Organisational Change, London, Harper and Row.

Coad, P and Yourdon, E. (1991) Object-Oriented Analysis. Yourdon Press Computing Series, Prentice Hall, Inc.

Conant, J. S., Mokwa, M. P., and Varadarajan, P. R., (1990), Strategic types, distinctive marketing competencies and organisational performance: a multiple measures-based study, Strategic Management Journal, Vol.11, pp.365-383.

Conklin, E.J., & W. Weil, (1998), Wicked Problems: Naming the Problems in Organisations, 3M Meeting Network, http://www.mmmco.de/...work/readingroom/gdss_wicked.html, last accessed 6/7/98.

Cornwall, A. and Jewkes, R., (1995) "What is Participatory Research?", Social Science and Medicine, 41(12), pp. 1667-1676.

Cummings, T. & Huse, E., (1989). Organization Development and Change (4th ed.). St. Paul, MN: West Publishing Company.

Cunningham, B., (1976), "Action research: toward a procedural model", Human Relations, 29(3) pp. 15-19.

Curran, J., and Blackburn, R. A., (2001), Researching the Small Enterprise, Sage Publications, London.

Dahlbom B. & Mathiassen L. (1993). Computers in Context: The Philosophy and Practice of Systems Design. Oxford: NCC Blackwell.

Dalton, M. (1959), Men who Manage, New York, John Wiley.

Dalton, M. (1964), Preconditions and Methods in 'Men who Manage'. In Hammond, P. E. (ed) (1964), Sociologists at work. New York, John Wiley.

Davenport T.H. (1993). Process Innovation. Reengineering Work through Information Technology. Harward: Harward Business School Press.

Davenport, T.H. and Short, J.E. (1990), "The new industrial engineering: information technology and business process redesign", Sloan Management Review, Summer, pp. 11-27.

Davidson, W. H. (1993). "Beyond Re-Engineering: The Three Phases of Business Transformation," *IBM Systems Journal*, Vol. 32, No. 1, January (reprinted in IEEE Engineering Management Review, Vol. 23, No. 2, Summer, 1996, pp. 17-26).

Dawson P. (1994). Organisational change: a processual approach. London: Paul Chapman Publishing.

Deeks, D., Harvey, C.F. and Edwards, H.M. (1997) The Future of BPR - Applying DFD Logicalisation. 7th Annual BIT Conference, Manchester, November.

Deetz, S. (1996) Describing differences in approaches to organization science: rethinking Burrell and Morgan and their legacy, Organization Science, 7:2, p191--207.

Delbridge, R. (1995), "Surviving JIT – Control and Resistance in a Japanese Transplant, Journal of Management Studies, 32(6), pp. 803-817.

Delbridge, R. and Kirkpatrick, I. (1994), "Theory and Practice of Participant Observation". In Wass, V, and Wells, P. (eds) (1994), Principles and Practise in Business and Management Research. Aldershot, Dartmouth.

DeMarco T. (1978). Structured Analysis and System specification. New York: Prentice-Hall.

Dennis, J. B. (1974). First Version of a Data Flow Procedural Language. In Lecture Notes on Computer Science (pp. 362 - 376). Springer-Verlag.

Denzin K. N. & Lincoln S. Y. ed. (2000). Handbook of Qualitative Research. 2:nd edition. Thousand Oaks, Cal: Sage Publications.

Doukidis G. I., Lybereas P. and Galliers R.D. (1996). Information-systems planning in small business - a stages of growth analysis, Journal of Systems & Software, Vol. 33, No. 2, pp. 189-201.

DTI, Department of Trade and Industry, (2002), Business in The Information Age: International Benchmarking Study 2002, HMSO, http://www.ukonlineforbusiness.gov.uk/benchmarking2002/index.html (last accessed 14-3-03).

Eason, K. (1988). Information Technology and Organisational Change. Taylor and Francis.

Eden, C. and Huxham, C. (1996), "Action research for Management Research", British Journal of Management. 7(1), pp. 75-86.

Edwards, C., Peppard, J. W. (1994), Business process redesign: hype, hope or hypocrisy?, Journal Of Information Technology, Volume 9, Issue 4, pp. 251-266.

Edwards, H.M and Mallalieu, G.M. (1999) RAMESES: A Method for Evaluating Change in Small Organisations, IEE Software Proceedings, Special Issue on SEBPC programme, June.

Edwards, H.M and Mallalieu, G.M. Legacy Systems in Small Organisations: A Reflection Based on Empirical Case Study Material. Submitted to Journal of Software Maintenance.

Edwards, H.M and Willoughby, S.C. (1998) Examination Of Current IT Systems Support For Business Processes In SMEs and a Suggested Strategy. tti98, Proceedings of Technology Transfer Innovation Conference, London, July 1998.

Edwards, H.M, Mallalieu, G.M. and Thompson, J.B. (1999), Some Insights into the Maintenance of Legacy Systems within Small Manufacturing and Distribution Organisations in the UK. 23rd IEEE conference on computer software and its applications (compsac99), Phoenix, Arizona, October.

Edwards, J and Harrison, R (1999). Workshop on Coevolution. IEEE International Conference on Software Maintenance, Oxford, August.

Eisenberg H. (1997). Reengineering and Dumbsizing: Mismanagement of the Knowledge Resource. Journal of Quality Progress, May, 1997. Publ. American Society for Quality.

Eisenhardt, K.M. (1989), Building theories from case study research, Academy of Management review, Volume 14, Issue 4, pp. 532-550.

Fiedler, KD, Grover, V, Teng, JTC.(1994) "Information Technology-Enabled Change - The Risks and Rewards of Business Process Redesign and Automation". Journal of Information Technology, Vol 9, No 4, pp267-275.

Flood, R. L. and M. C. Jackson, (1991), Creative Problem Solving: Total Systems Interaction, Chichester, UK: Wiley.

Foster, M. (1972), "An introduction to the theory and Practice of action research in work organisations", Human Relations, 25(6), pp. 529-556.

Francis, A. and MacIntosh, R. (1997), "The market, technological and industry context of business process re-engineering in the UK", International Journal of Operations and Production Management, Vol. 17, No. 3-4, p.344.

Friedrichs, J. and Lüdtke, H. (1975), "Participant observation: theory and practice". Westmead, Hampshire, Saxon House.

Friis S. (1991). User Controlled Information Systems Development - problems and possibilities towards Local Design Shops. Dept of Information & Computer Science, Lund: Lund University.

Fromm E. (1956). The Art of loving, Harper and Row, New York.

Fromm, E. (1981). To Have or To Be. New York: Bantam Books.

Gadamer, H.-G. 1976. Philosophical Hermeneutics. Berkeley: University of California Press.

Gadd, K. (1994), "Chimera or culture? Business Process Re-engineering for total quality management", MBA Dissertation, University of Bradford.

Galliers R.D. (1993) 'IT Strategies: Beyond Competitive Advantage' J. Strategic Info. Sys. 2,4 (December 1993) 283-291.

Galliers, R. D., (1991), "Choosing Appropriate Information Systems Research Approaches: A Revised Taxonomy", in H. E. Nissen, H. K. Klein, and R. Hirschheim (eds.) Information Systems Research: Contemporary Approaches and Emergent Traditions, Amsterdam: E.

Galliers, R. D., and Sutherland, A. R. (1991). "Information Systems Management And Strategy Formulation: 'The Stages Of Growth' Model Revisited," Journal of Information Systems, Vol. 1, No. 2, pp. 89-114.

Galliers,R and Baker B,S,H.(1995) "An Approach to Business Process Reengineering - The Contribution of Sociotechnical and Soft OR Concepts" INFOR, Vol 33, No 4, pp263-278.

Gaughan, T.R. (1996), "The systems dimension of process re-engineering", CMA Magazine, November, pp. 12-15.

Gemmer, A. (1997), "Risk Management: Moving beyond process", IEEE Computer magazine, Vol. 30, No 5, pp. 33-43.

Giaglis, G,M. (2001). A Taxonomy of Business Process Modelling and Information Systems Modelling Techniques. Technical Report, Department of Information Systems and Computing, Brunel University, Uxbridge.

Gibson, M.L. and Whitman, M.E. (1997), "IT importance in supporting reengineering: Performance perceptions versus reality", Journal of Computer Information Systems, Vol.37, No4, pp. 18-23.

Giddens, A. (1984), The Constitution of Society: An Outline of the Theory of Structuration, Polity Press, Oxford.

Giddens, A., (1989), 'Response to my critics'. In D. Held and J. Thompson (eds), social theories of modern societies: Anthony Giddens and his Critics. Cambridge: Cambridge University Press.

Gill, J. and Johnson, P. (1991), Research Methods for Managers, London, Chapman Paul.

Glaser, B. and Strauss, A. L. (1967),The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago, Qualitative Research, Chicago, Aldine Publishing Co.

Goguen, J. A., & Burstall, R. M. (1977). Putting Theories Together to Make Specifications. In International Joint Conference on Artificial Intellegence, (pp. 1045 - 1058).

Grindley, K. (1991), IT in the boardroom, Pitman Publishing, London.

Grint, K. and Willcocks, L "Business Process Reengineering In Theory And Practice - Business Paradise Regained", New Technology Work And Employment, Vol.10, No2, 1995, Pp.99-109.

Grover, V., Teng, J.T.C. And Fiedler, K.D. (1994), "Exploring the success of information technology enabled business process reengineering", IEEE Transactions on Engineering Management, Vol. 41, No. 3, pp. 276-284.

Gruhn V. (1995). Business Process Modelling And Workflow Management. International Journal of Co-operative Information Systems, 4 (2-3) pp.145-164.

Grundy, J., (1999), Aspect-oriented Requirements Engineering for Component-Based Software Systems, 4th IEEE International Symposium on Requirements Engineering.

Guha, S. Kettinger, W.J. and Teng, J.TC. (1993), "Business process reengineering: building a comprehensive methodology", Information Systems Management, Vol. 10, No. 3, pp. 13-22.

Gummeson, E. (1991), "Qualitative Methods in Management research", California, Sage Publications.

Guttag, J. V.,Horning, J. J., & Modet, A. (1990). Report on the Larch Shared Language Version 2.3 (SRC — Research No. 58). Digital Equipment Corporation.

Habermas J. (1984). The Theory of Communicative Action. Boston: Beacon Press.

Habermas, J., (1972), Knowledge and Human Interests, London Heinman.

Hägerfors A. (1994). Co-learning in Participative Systems Design. Dept of Informatics, Lund: Lund University.

Hale A. J. and Cragg P. B. (1996). Business Process Reengineering in the Small Firm - A Case-Study' INFOR, Vol. 34, No 1, pp. 15-27.

Halloran, P., (1998), Organisational Learning from the Perspective of a Software Process Assessment and Improvement Program, Thirty-first Annual Hawaii International Conference on System Sciences, (HICSS-98): Volume 6 - Organizational Systems and Technology.

Hammer M. & Champy J. (1995). Reengineering the Corporation: A Manifesto for Business Revolution. London: Nicholas Brealey Publishing.

Hammer M. (1990). Reengineering work: don't automate, obliterate, Harvard Business Review, Volume July-Aug, pp. 104-112.

Hammer, M and Champy, J (1993). Reengineering the Corporation: A Manifesto for Business Revolution. London, Nicholas Brearley.

Hammer, Michael, and James Champy. Reengineering the Corporation: Manifesto for Business Revolution. London: Bealey, 1994.

Handy C. (1992). The Age of Unreason, Arrow Books, London.

Haraway D. (1985). A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s. Socialist Review, 80, pp. 65-107.

Haraway D. (1992). Primate Visions: Gender, Race and Nature in the World of Modern Science. London: Verso.

Harker, S. D. P., & Eason, K. D. (1985). Task Analysis and the Definition of User Needs (Technical No. 330). HUSAT Research Centre.

Hassard J. (1993). Sociology and Organization Theory: Positivisms, Paradigms and Postmodernity, Cambridge University Press, Cambridge.

Heygate, R. (1993), Accelerating the payback from Information technology: the "surround" approach., Managing Change to get results, McKinsey & Co.

Hirschheim, R., Klein, H. K., (1992) Paradigmatic Influences on Information Systems Development Methodologies: Evolution and Conceptual Advances. Advances in Computers 34:pp 293-392.

Hirschheim, R. A., Klein, H. K., (1994), Realising emancipatry principles in information systems development: the case for ETHICS. MIS Quarterly, March 1994, p83-109.

Hirschheim, R. and H. K. Klein, (1989), "Four Paradigms Of Information Systems Development", Social Aspects of Computing (32)10.

Hofstede G. (1991): Cultures and organisations: software of the mind. McGraw-Hill, London.

Holt, A. W. (1988). Diplans : A New Language for the Study and Implementation of Coordination. ACM Transactions of Office Information Systems, 6(2), 109 - 125.

Hult, M. and Lennung, S. A., (1978), What is Action Research. Pedagogical Bulletin, University of Lund, No. 5. In Gummeson (1991).

Ince, D., & Andrews, D. (1991). The Software Life Cycle. Butterworths.

Ives, B., Hamilton, S., Davis, G., (1980), 'A Framework for research in computer based management information systems', Management Science, 26(9): 910-34.

Jackson M. A. (1983). Systems Development. New Jersey: Prentice Hall.

Jarzabek, S. and Ling, T.W. (1996), "Model-based support for Business reengineering", Information & Software Technology, Vol. 38, No. 5, pp. 355-374.

Jayaratna N. (1994). Understanding and Evaluating Methodologies - NIMSAD: A Systemic Framework. Berkshire: McGraw-Hill.

Jonsson, S., (1991), Action Research, in Nissen H.E., Klein, H. K., Hirschheim, R., (eds), Information Systems research: Contemorary Approaches and Emergent Traditions, 1991, Elsevier Science Publishers, North Holland, p371-396.

Jorgensen, D. L., (1989), Participant Observation: a methodology for human studies, London Sage Publications.

Kaplan, B. and J. A. Maxwell, (1994), "Qualitative Research Methods for Evaluating Computer Information Systems" in J. G. Anderson, C. E. Aydin, and S. J. Jay (eds.) Computers in Health Care: Research and Evaluation, London, UK: Sage.

Keen, P. G. W., (1991), "Relevance and Rigor in IS Research: Improving Quality, Confidence, Cohesion and Impact", in H. E. Nissen, H. K. Klein, and R. Hirschheim (eds.) Information Systems Research: Contemporary Approaches and Emergent Traditions, Amsterd.

Kets de Vries (1980). Organisational Paradoxes: Clinical Approaches to Management, Tavistock, New York.

Kettinger, W. J. (1994), National infrastructure diffusion and the U.S. information super highway, Elsevier Science B.V.

Kettinger, W.J, Teng, J.T.C. and Guha, S, (1996), "Information architectural design in Business process reengineering", Journal Of Information Technology, Vol. 11, No. 1, pp. 27-37.

Khalil, O E.M. (1997), "Implications for the role of information systems in a business process reengineering environment", Information Resources Management Journal, Vol. 10, No. 1, pp. 36-43.

King S. (1996). Case Tools and organisational action, Information Systems Journal, 6, 173-194.

Klein, H. K. and M. D. Myers, (1999), "A Set of Principles for Conducting and Evaluating Interpretative Field Studies in IS", MIS Quarterly (23)1.

Kling R. (1999). What is Social Informatics and Why Does it Matter? D-Lib Magazine January 1999 Volume 5 No 1. http://www.dlib.org/ (valid 06 Dec 2000).

Kolf, F., & Oppelland, H. J. (1983). Design Oriented Approach in Implementation Research. The Project PORGI. In Human Factors in Computing Systems, 26 . ACM Press.

Kontio, J., Getto, G., Landes, D., (1998), Experiences in Improving Risk Management Processes Using the Concepts of the Riskit Method, SIGSOFT'98, Sixth International Symposium of the Foundations of Software Engineering (FSE-6), November 3-5, 1998.

Kraemer, K.L. & Dutton, W.H. (1991) Survey research in the study of management information systems, in Kraemer, K.I. (ed.): The information systems research challenge: survey research methods, Harvard Business School Research Colloquium, v.3, Harvard Business School, Boston, p.3-57.

Lamb, S. S.,Leck, V. G.,Peters, L. J., & Smith, G. L. (1978). SAMM: A Modelling Tool for Requirements and Design Specification. In Computer Software and Applications Conference (Compsac), (pp. 48 - 53). IEEE Computer Society Press.

Langefors B. (1966). Theoretical Analysis of Information Systems. Lund: Studentlitteratur.

Langefors B. (1995). Essays on Infology - Summing up and Planning for the Future. Lund: Studentlitteratur.

Latour B. (1987). Science in Action. Milton Keynes: Open University Press.

Latour B. (1999). Pandora's Hope, Essays on the reality of science studies. Cambridge Mass: Harvard University Press.

Lee, A.S. (1991), "Integrating positivist and interpretive approaches to organizational research", Organization Science, Vol. 2, No. 4, pp. 342-365.

Lee, R. M. (1988). Bureaucracies as Deontic Systems. ACM Transactions on Office Information Systems, 6(2), 87 - 108.

Lee, S., & Sluizer, S. (1991). An Executable Language For Modelling Simple Behaviour. IEEE Transactions on Software Engineering, SE-17(6), 527 - 543.

Lewin, K., (1951), Field Theory in Social Science, New York, Harper and Row.

Longworth, G. (1989). Getting the System You Want - A User's Guide to SSADM. NCC Publications.

Lucas, P. (1987). VDM: Origins, Hopes and Achievements. In Lecture Notes in Computer Science (pp. 1 - 18). Springer-Verlag.

Ludwig, P., Kaufmann, T., Liebmann, H., (1998), An organisational Framework for Mass-Customised Business Applications, 2nd European Conference on Software Maintenance and Reengineering.

Lunberg, M. (1982). The ISAC Approach to Specification. In Information Systems Design Methodologies: Improving on Practice North Holland Press.

Lyons, G. (1995), "Application of information technology in the redesign and implementation of business processes", Proceedings of IFIP Conference on Reengineering the enterprise, pp55-64, Chapman and Hall, Galway, Ireland.

Lyytinen, K.,Auramaki, E., & Hirschheim, R. (1991). Modelling Offices Through Discourse Analysis: The SAMPO Approach. The Computer Journal, 35(4), 342 - 352.

Lyytinen, K.(1992) "Information systems and critical theory," in *Critical Management Studies,* M. Alvesson, and H. Willmott (eds.), Sage Publications, London, pp. 159-180.

MacArthur, P.J., Crosslin, R.L., Warren, J. R., (1994), "A strategy for evaluating alternative information-system designs for business process reengineering", International journal of Information Management, Vol.14, No4, pp.237-251.

MacLean, R.,Stepney, S.,Smith, S.,Gradwell, D.,Hoverd, T.,Katz, S., & Tordoff, N. (1994). Analysing Systems: Determining Requirements for Object-Oriented Development. Prentice-Hall.

Mahony K. & Van Toen B. (1990). Mathematical Formalism as a Means of Occupational Closure in Computing - why 'hard' computing tends to exclude women. Journal of Gender and Education, No. 2/3, pp. 319-331.

Mallalieu G. and Bednar P. (2001). A critical approach to representing process.The 10th SEISN (Software Engineering and Information Systems Network) Workshop at the Imperial College, London. Theme: Business Process Modelling and Systems Evolution. 11 January 2001. http://www.ase.rdg.ac.uk/seisn/archive/2001/010111/report.htm.

Mallalieu,G.M. and Edwards, H.M.(2000) Managing COTS-Based Systems in Small Organisations: What the RAMESES Method Can Offer. ICSE Workshop Paper, Limerick June.

Markosian, L., Newcomb, P., Brand, R, Burson, S and Kitzmiller, T. (1994), "Using an Enabling Technology to Reengineer Legacy systems", Communications of ACM, Vol. 37. No. 5, pp. 58-70.

Markus, M. L., and Lee. A. s., 1999. Special Issue on Intensive Research in Information Systems: Using Qualitative, Interpretive, and Case Study Methods to Study Information Technology—Foreword, MIS Quarterly, 23, 1 (March): 35-38.

Marsh K. (1982). The survey method. London: Allen & Unwin.

Martinsons M. G. and Revenaugh D. L. (1997). 'Re-engineering is dead; Long live re-engineering', International Journal of Information Management, Vol. 17, No. 2, pp. 79-82.

Mason, R. (1989a) MIS experiments: a pragmatic perspective, in BENBASAT, I. (ed.): The information systems research challenge: survey research methods. Harvard Business School Research Colloquium, v.2, Harvard Business School, Boston, p.3-20.

Mason, R. O. and I. I. Mitroff, (1973) "A Program for Research on Management Information Systems", Management Science (19)5.

McGowan, C. and Bohner, L. (1993) Model Based Process Improvement. 15th International Conference on Software Engineering, Baltimore, Maryland, USA.

McNiff, J., (1988), Action Research: Principles and Practice. London, Macmillan Education Ltd.

McSwinney, J. (1995), "Business process reengineering for small and medium-sized manufacturing enterprises", Proceedings of IFIP Conference on Reengineering the enterprise, Chapman and Hall, Galway, Ireland.

Menzies, T., Easterbrook, S., Nuseibeh, B., Waugh, S., (1999), An empirical investigation of multiple viewpoint reasoning in requirements engineering, 4th IEEE International Synposium on Requirements Engineering, Limerick, Ireland.

Miles R. E. & Snow C. C. (1978). 'Organisation Strategy, Structure and Process', New York: McGraw Hill.

Miller, D. (1990), The Icarus paradox, Harper Business, New York.

Mills C. W. (1959). The Sociological Imagination, New York: Oxford University Press.

Min, DM;Kim, JR;Kim, WC;Min, DW;Ku, S. IBRS - Intelligent Bank Reengineering System. Decision Support Systems, Vol 18, No1, 1996, pp97-105.

Mitroff, I. I. and H. A. Linstone, (1993), The Unbounded Mind: Breaking the Chains of Traditional Business Thinking, Oxford University Press.

Mumford & Beckman, (1994), Tools for Change and Progress: A socio-technical approach to business re-engineering, Netherlands, CSG Publications.

Mumford E. & Hendricks R. (1996). Business Process Re-Engineering RIP. People Management, May 1996, pp. 22-29.

Mumford E. (1983). Designing Human Systems. Manchester: Manchester Business School.

Mumford, E, Beekman, G.J. and Mitev, N.N. (1996), "Tools for change and progress - a socio-technical approach to Business Process Reengineering", Personnel Review, Vol. 25, No. 4, p. 56.

Musa, J.D. (1979), "Software reliabilty measures applied to System Engineering", Vol. 48, pp. 941-946.

Myers, M. D., (1997), "Qualitative research in information systems", MIS Quarterly, 21(2), pp. 241-242.

Nardi B. ed. (1996). Context and Consciousness: Activity Theory and Human Computer Interaction. Cambridge, Mas: Minformation technology Press.

Nelson, R., Winter, S., 1982, An evolutionary theory of economic change, Belknap Press, Cambridge, MA.

Nicholls, D. (1987). Introducing SSADM - The NCC Guide. NCC Publications.

Niessink, F., and van Vliet, H., (1998), Two Case Studies in Measuring Software Maintenance Effort. International Conference on Software Maintenance, 16-19 November 1998, Bethesda, Maryland.

Nissen H-E. (1986). Investigation of Opinions on Good Information Systems Research. IFIP WG8.2, 1986-08-15, Lund: Informatics, Lund University.

Oberquelle, H. (1998). Role/Function/Action-Nets as a Visual Language for Cooperative Modelling. In IFIP International Workshop on Human Factors of Information Systems Analysis and Design.

Orlikowski, W. "Integrated Information Environment or Matrix of Control? The Contradictory Implications of Information Technology," Accounting, Management and Information Technolgies (1:1), 1991, pp. 9-42.

Orlikowski, W., Baroudi, J., (1991), Studying Information technology in organisations:research approaches and assumptions, Institute of manangement science, Vol. 2 No 1, pp1-28.

Orlikowski, W.J. (1993), "CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development" Management Information Systems Quarterly, Vol 17, No 3.

Ould, M.A. (1995) Business Processes Modelling and Analysis for Re-engineering and Improvement. John Wiley & Sons, Chichester.

Parnaby, J. (1994), "Business Process systems engineering", International Journal of Technology Management, Vol. 9, No. 3/4, pp. 497-508.

Pava, C. (1983). Managing New Office Technology: An Organisational Strategy. New York: Free Press.

Pereira, Z.L. and Aspinwall, E. (1997), "Total quality management versus business process re-engineering", Total Quality Management, Vol. 8, No. 1, pp. 33-39.

Pettigrew A. M. (1985). Contextualist Research: A Natural Way to Link Theory and Practice in Lawler III E E et al: Doing Research that is Useful for Theory and Practice, Jossey-Bass

Publishers, San Francisco. Rogers E. (1995). Diffusion of Innovations. 4:th edition. New York: The Free Press.

Pettigrew, A. (1990) "Longitudinal Field Research on Change: Theory and Practice," Organizational Science, Volume 1, 1990, pp. 267-292.

Pfleeger, S., L., (1998), Making Change: The 'Other' Components of Software Maintenance, Keynote Address. International Conference on Software Maintenance, 16-19 November 1998, Bethesda, Maryland.

Prasad, P. and Prasad, A., (1994), "The ideaology of professional work computerisation – An institutionalist study of technological change", Human Relations, 47(12), pp. 1433-1458.

Prasad, P., (1993), "Symbolic Processes in the implementation of Technological Change – A symbolic Interactionist study of work computerisation", Academy of Management Journal, 36(6), pp. 1400-1429.

Pries-Heje, J. "Three barriers for continuing use of computer-based tools in IS development: A grounded theory approach". I: Scandinavian Journal of Information Systems. 1992, Volume 4, s. 119-136.

Raymond, L. (1992), Computerisation as a factor in the development of young entrepreneurs, International small business journal, Volume 11, Issue 1, pp. 23-34.

Rein, G. L., & Singh, B. (1992). Role Interaction Nets (RINs): A Process Description Formalism (Technical No. CT-083-92). Micro-Electronics and Computer Technology Corporation (MCC).

Rittel H.J., Webber, M.M., (1984), Planning problems are wicked problems. In Developments in Design Methodology. (Cross N., Ed), pp. 135-144. Wiley.

Roethlisberger, F. J., and Dickson, W. J., (1956), Management and the worker, Cambridge, Massachusetts.

Rosen, M., (1991), "Breakfast at Shaperio's: dramaturgy and dominance", In Frost, P., Moore, L., Louis, M., Lundberg, C. and Martin, J. (eds), (1991), Reframing Organisational Culture, California, Sage.

Roy, D., (1952), "Quota restrictions and goldbricking in a machine shop", American Journal of Sociology, 57, pp. 427-442.

Royce, W.W. (1970) Managing the development of large software systems: Concepts and Techniques, Proceedings of WESCON.

Rumbaugh, J.,Blaha, M.,Premerlani, W.,Eddy, F., & Lorensen, W. (1991). Object Oriented Modelling and Design. Prentice Ahll.

Ryan, G. M.,Wynne, R. F.,Cullen, K. M.,Ronayne, T. R., & Dolphin, C. (1988). Human and Economic Factors in the Uptake Processes. Volume 1. Concepts and Methodology for Understanding and Managing IT Uptake Processes in User Organisations (Technical No. ESPRIT Project 1030). Work Research Centre.

Sahay, S. and Walsham, G. (1995) Information technology in developing countries: a need for theory building, Information Technology for Development, 6(3/4), 111-124.

Sakthivel, S., "A Decision Model to Choose between Software Maintenance and Software Redevelopment", Journal of Software Maintenance: Research and Practice, 1994, Vol.4, p.121 - 143.

Sandstrom G. (1985). Towards Transparent Data Bases - How to Interpret and Act on Expressions Mediated by Computerized Information Systems. Lund, Sweden: Studentlitteratur & Chartwell-Bratt Ltd.

Sauer C. (1993). Why Information systems Fail: A case study approach, Henley-on-Thames, Alfred Waller.

Saunders, M., Lewis, P. and Thornhill, A., (1997), Research Methods for business students, Londoon, Pitman Publishing.

Schon, D. A., (1987/91), Educating the Reflective Practitioner, London, UK: Jossey-Bass

Searle, J. R. (1969). Speech Acts - An Essay in the Philosophy of Language. Cambridge University Press.

Shurville et al., (1997), A development methodology for composer: a computer support tool for academic writing in a second language. In Jakobs and Knorr (eds.) 1997, The production of scientific texts in the age of the computer.

Sia, C L., Tan, B. C.Y., Teo, H., Wei, K., (1997), "Applying total quality concepts to continuous process redesign", International journal of information management, Vol. 17, No.2, pp.83-93.

Silverman D. (1995). Qualitative Research: meanings or practices?, Information Systems Journal, 8, 3-20.

Silverman, D., (1998), Qualitative Research: meanings or practices?, Information Systems Journal, 8, pp. 3-20.

Singh, B. (1992). Interconnected Roles (IR): A Coordination Model (Technical No. CT-084-92). Micro-Electronics and Computer Technology Cororation - MCC.

Sjostrand S-E. (1997). The Two Faces of Management - The Janus Factor. London: International Thomson Business Press.

Slevin, D. P., Covin, J.G., (1990), Juggling Entreprenurial style and organisational structure: How to get your act together, Sloan management review, Summer.

Sneed, H. M., "Planning the Re-engineering of Legacy Systems", IEEE Software, January 1995, Vol.12 , No.1, p.24 - 34.

Spivey, J. M. (1989). The Z Notation - A Reference Manual. Prentice Hall.

Stamper, R. (1985). Management Epistemology: Garbage In, Garbage Out. (And What About Deontology and Axiology ?). In Knowledge Representation for Decision Support Systems (pp. 55 - 77). Elsevier Science.

Stephens, S. S., & Tripp, L. L. (1978). Requirements Expression and Verification Aid. In International Conference on Software Engineering - ICSE, (pp. 101 - 108). IEEE Computer Society Press.

Strauss & Corbin, (1997), Grounded Theory in Practice, Sage Publications, London.

Suchman, L., (1995), "Making Work Visible: How People Work is One of the Best Kept Secrets in America", Communications of the ACM (38)9.

Szyperski, C., (1998), Component Software, London, Addison Wesley.

Tam, A.S.M., Chu, L.K. and Sculli,D. (2001) Business Process Modelling in Small – to – Medium Sized Enterprises. Journal of Industrial Management and Data Systems, MCB University Press, 101/4 pp144-152.

Taylor J. A. (1995). Don't obliterate, informate!: business process re-engineering for the information age, New Technology, Work and Employment, 10:2 pp.82-88.

Taylor, F.W., (1911), "Principles of Scientific Management", Harper, New York.

Teichroew, D., & Hershey, E. A. (1977). PSL/PSA: a computer approach to information processing systems modelling. IEEE Transactions of Software Engineering, SE-3(1), 41 - 48.

Tenant, M., (2002), The development of a business process mapping tool for use within SMEs: an investigation into current tools and techniques within the SME dynamic. Unpublished Msc thesis, University of Northumbria.

Teng J. T. C., Grover V. and Fielder K. D. (1994). Business Process re-engineering: Charting a strategic path for the information age, California Management Review, Spring, 1994.

Teng, J.T.C, Grover, V. and Fiedler, K.D. (1994), "Re-Designing Business processes using Information Technology", Long range planning, Vol. 27, No. 1, pp. 95-106.

Teng, J.T.C. and Kettinger, W.J. (1995), "Business process redesign and information architecture - exploring the relationships", Data Base For Advances In Information Systems, Vol.26, No1, pp.30-42.

Tieze, S., (1998) The Role of Language in the process of Creating Meaning in a Professional Organisation. Unpublished PhD Thesis, Sheffield Hallam University.

Tinnilä, M, (1995), "Strategic perspective to business process redesign", Business Process Management Journal, Vol 1, No 1, pp. 44-59.

Trauth, E.M. and O'Connor, B. A study of the interaction between information technology and society: An illustration of combined qualitative research methods in Information Systems Research: Contemporary Approaches & Emergent Traditions. H.- E. Nissen, H.K. Klein and R. Hirschheim (eds.), North-Holland, Amsterdam, 1991, 131-144.

Tse, T. H., & Pong, L. (1991). An Examination of Requirements Specification Languages. The Computer Journal, 34(2), 143 - 152.

Ulrich W. (1997a). A Short Introduction to Critical Systems Heuristics. Ph.D. Students Seminar Series, Lincoln School of Management, University of Lincolnshire & Humberside, Lincoln, UK, 4. December 1997.

Ulrich W. (1997b). If Systems Thinking is the Answer, What is the Question? How to Become a Competent Systems Researcher, Ph.D. Students Seminar Series, Lincoln School of Management, University of Lincolnshire & Humberside, Lincoln, UK, 20. November 1997.

Ulrich W. (2000). Reflective Practice in the Civil Society: the contribution of critically systemic thinking. Reflective Practice, Vol.1, No.2, pp247-268.

Ulrich. W., (1986), Critical Heuristics of social systems design', Working Paper 10, Department of management science and systems, University of Hull.

Urquhart, C. "Exploring Analyst-Client Communication: Using Grounded Theory Techniques to Investigate Interaction in Informal Requirements Gathering," in *Information Systems and Qualitative Research*, A.S. Lee, J. Liebenau and J.I. DeGross (eds.), Chapman and Hall, London, 1997, pp. 149-181.

Venkatraman, N. (1991), IT induced business reconfiguration, "The Corporation of the 1990s: Information Technology and Organisational transformation", Scott Morton, M.S. (ed.), Oxford University Press, Oxford.

Voas, J., (1998), Maintaining Component-Based Systems, IEEE Software, vol.15, No.4: July/August, pp.22-27.

Walsham G. (1993). Interpreting information systems in organisations. Chichester: John Wiley & Sons.

Walsham G. and Sahay S. (1999). Ginformation system for district-level administration in India: problems and opportunities, Minformation system Quarterly, 23 (1), 39-66.

Walsham, G., (1993b), "Ethical Issues In Information Systems Development: The Analyst As Moral Agent", in D. A. Avison, J. E. Kendall and J. I. De Gross (eds) Human Organizational and Social Dimensions of IS Development, Amsterdam: Elsevier Science, IFIP.

Walsham, G., (1995), "The Emergence of Interpretivism in IS Research", Information Systems Research (6)4.

Waring, T., Bryans, P and Mavin, S., (2003) Learning to be Critical in Management Research: Towards a Reflexive Methodology, Proceedings of the 2nd European Conference on Research Methods, Reading.

Wastell, D. G., (1993), "Social Dynamics of Systems Development: Conflict, Change and Organizational Politics", in S. Easterbrook (ed.) CSCW: Cooperation or Conflict?, London, UK: Spinger-Verlag.

Wastell, D. G., (1996), "The Fetish of Technique: Methodology as a Social Defence", Information Systems Journal (6)1.

Weick K. (1995). Sensemaking in organisations. Thousand Oaks, Cal: Sage Publications.

Westbrook, R., (1995), "Action research: a new paradigm for research in production and operations management", International Journal of Production and operations management, 15(12), pp. 6-20.

Whyte, G. and Bytheway, A. (1996), "Factors affecting information systems' success", International Journal of Service Industry Management, Vol. 7, No. 1, pp. 74-93.

Whyte, W. F., and Hamilton, E. L., (1964), Action Research for Management, Illinois, R. D. Irwin.

Whyte, W., (1991), Participatory Action research, London, Sage.

Wiener N. (1948). Cybernetics. New York: John Wiley & Sons.

Wiener N. (1950). The Human Use of Human Beings: Cybernetics and Society. Boston, Mass: Houghton Mifflin.

Willcocks,L and Smith, G. "IT Enabled Business Process Reengineering - Organisational and Human Resource Dimensions" Journal of Strategic Information Systems, Vol 4, No 3, 1995, pp279-301.

Willmott, H. (1994), "Business Process Reengineering and Human-Resource Management", Personnel Review, Vol. 23, No. 3, pp. 34-46.

Winch, P., (1960), The idea of a social science and its relation to philosophy, London, Routledge & Kegan Paul.

Wood-Harper A. T., Antill L. and Avison D. E. (1985). Information Systems Definition: The Multiview Approach. Oxford: Blackwell Scientific Publications.

Wood-Harper, A.T. "Viewpoint: Action Research," Journal of Information Systems (2), 1992, pp. 235-236.

Yin, R. (1989) Case study research: design and methods. Applied Social Research Methods Series, v.5, rev. ed. Newbury Park (CA): Sage Publications.

Yourdon, E. (1989) Modern Structured Analysis. Prentice Hall, New Jersey.

Zairi, M. (1997), "Business process management: a boundaryless approach to modern competitiveness", Business Process Management Journal, Volume 3, No. 1, pp. 64-80

Zairi, M. and Sinclair, D. (1995), "Business process re-engineering and process management: A survey of current practice and future trends in integrated management", Business Process Management Journal, Vol. 1, No. 1, pp. 8-30.

Zave, P. (1991). An Insider's Evaluation of PAISLey. IEEE Transactions of Software Engineering, SE-17(3), 212 - 225.

Zmud, R. W., (1998), "Conducting and Publishing Practice-Driven Research", IFIP 8.2/8.6 Conference, Helsinki, Dec.

Additional analysis material

Project problems

The system implementation has become sluggish and tedious due to poor response times from the suppliers. Issues raised were often subject to serious delays which has had a detrimental effect on morale within the user group. The key problem area of 'backflushing' has polluted the successful areas of implementation. The original system specification for the MRP system called for 'backflushing' and it seems iniquitous that a chargeable upgrade is now required to fulfil that system requirement.

Future work

Future work that could aid organisational progress is as follows:

- Develop a well-resourced user group.
- Widen the scope of the user survey to gather further information on system needs.
- Respond to needs identified so far, in terms of report generation etc.
- Incorporate future ERP development onto the scoping of a Teaching Company Scheme specification.

Observations of the research

During the course of this research several observations have been made which should be brought to the attention of the management team.

- Throughout the mapping process there was a distinct lack of clarity from the workforce as to the definition of business processes. This was evidenced in no explicitly named processes or tasks and is evidenced by the difficulty experienced when undertaking the system impact analysis. This factor could be redressed within the process training identified in section 3 above by developing process consensus throughout the workforce.

A critical approach to business process modelling in small to medium sized enterprizes

Appendices

Gillian Margaret Mallalieu

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APPENDIX 1

RAMESES method

The RAMESES Method:

Decision Support for Systems Change in SMEs

(A Guide for SMEs).

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Contents

1 Method Overview

When decision makers are assessing the risk involved in changing an IT system in an organisation there are three aspects need to be considered:

- The proposed change and its characteristics.
- The system factors impacting on and impacted by the change.
- The organisational factors impacting on and impacted by the change.

This range of factors involved can be summarised as shown in Figure 1-1.

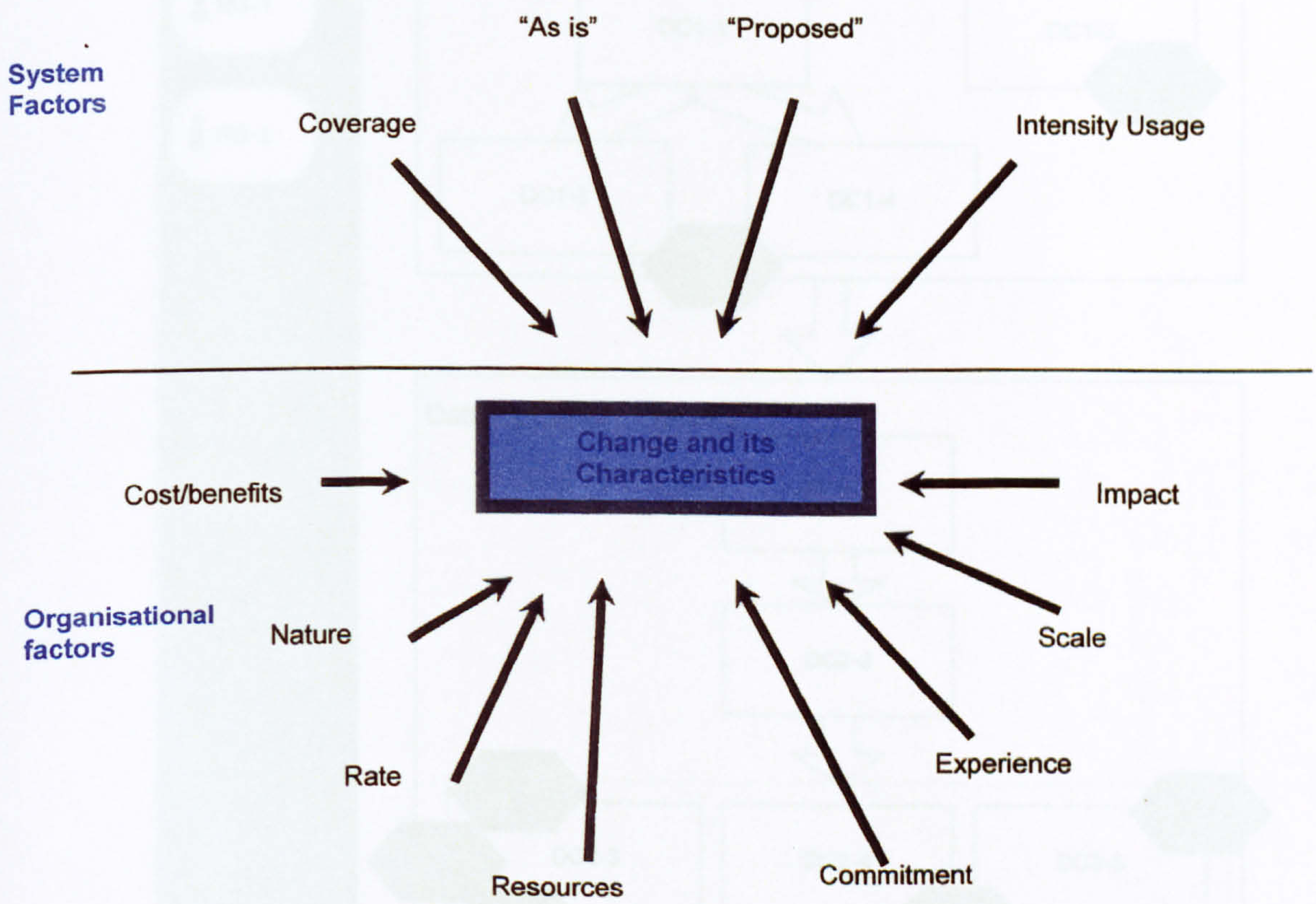


Figure 1-1: The Factors Affecting Systems Change.

The RAMESES method provides a toolkit for decision makers to use during this risk analysis process. This includes data collection tools, data analysis tools and risk gauges. Moreover, the approach also maps out (procedurally) how these tools can be used to evaluate risk at different phases within the system tendering (or system development) process – from system proposal to post implementation audit.

The method and its three main components (data collection, data analysis and risk assessment) are shown schematically in Figure 1-2. The diagram shows that to begin the RAMESES process a systems change must be identified and characterised. Thereafter, what drives the method is the data collection process. At certain points within data collection particular sets of data become available and therefore, specific (named) data analysis tools can be used to compare the existing and planned systems deployment. The third component of the method, the risk assessment, is shown on the diagram as a continuous strand: at any time during the use of the method the senior management team can gauge the risk of their proposed course, using the information and analyses conducted to that point.

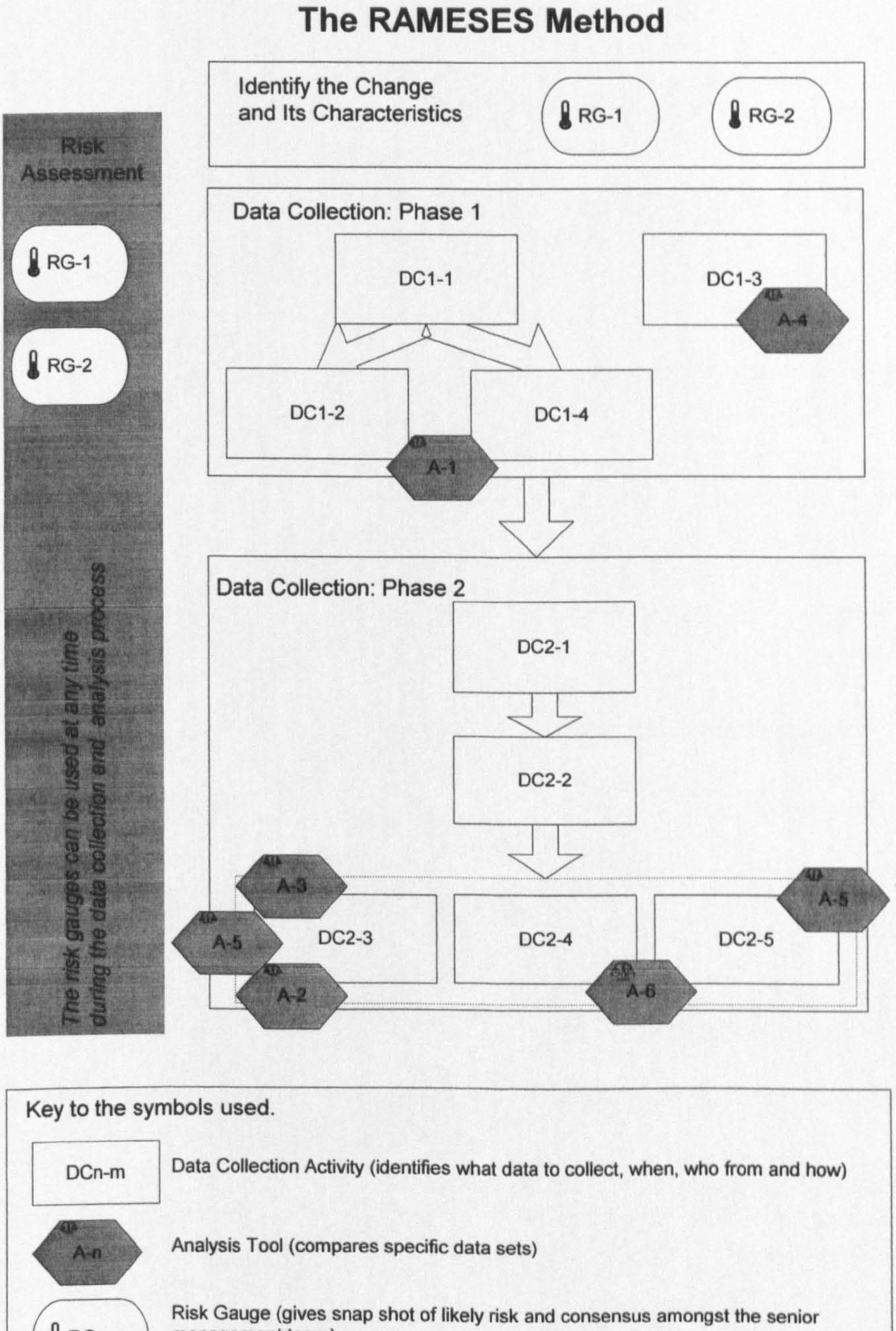


Figure 1-2: The Schematic View of RAMESES

2 Identify the Change and Its Characteristics

The decision to make changes to systems or business operations will always remain with those running the organisation. RAMESES helps to evaluate the impact of such changes. Therefore to start using the method at any time the manager proposing a change needs to both identify this change and its characteristics. To evaluate whether this proposal should be taken any further, the remainder of the senior management team (SMT) are asked to show there level of agreement about the need for the change **and** its characteristics.

The method provide three simple workpacks for gathering this information: WP/IC and WP/ICC (which identifies the change and the consensus among the SMT) and WP/CC which gathers the information about the **characteristics of the change.** The sample report below shows the results of this process.

Where there is consensus about the need for the change then progressing further is sensible. If there is a lack of consensus a sensible plan would be to abandon the proposed change until the justification for it is accepted by the team as sufficient.

Identified change:

Implementation of new ERP system to replace packages currently used with an integrated solution

Justification of need for change:

Our system is out of date and difficult to maintain
and
We know we are not operating at best efficiency and wish to investigate further.

Consensus among SMT:

Strongly Agree	2
Agree	1
Don't know/ No view on the proposed change	1
Disagree	0
Strongly Disagree	0

Figure 2-1: Example of Initial Change Consensus among the Senior Management

The example in Figure 2-1 shows a specific need has been identified and justified. Moreover, there is support for the change among other senior managers – with one neutral view expressed. In such a situation progressing further the proposed change and using RAMESES to understand it better seems appropriate.

The analysis of the proposed change in light of the experience and expertise of the organisation is shown in Figure 2-2.

	Expected Impact	Match with experience
Time scale of proposed system change		
Manager Proposing Change	Within 1 month	Poor
Senior Manager 1	Within 6 month	Best
Senior Manager 2	Within 6 month	Best
Senior Manager 3	Within 6 month	Best
Senior Manager 4	Within 6 month	Best
Scale of the proposed system change		
Manager Proposing Change	51% to 75%	Good
Senior Manager 1	51% to 75%	Good
Senior Manager 2	51% to 75%	Good
Senior Manager 3	76% to 100%	Poor
Senior Manager 4	51% to 75%	Good
Nature of the proposed system change		
Manager Proposing Change	Completed within a fixed period of time	Best
Senior Manager 1	Gradual implementation/systems in tandem	Good
Senior Manager 2	Completed within a fixed period of time	Best
Senior Manager 3	Gradual implementation/systems in tandem	Good
Senior Manager 4	Gradual implementation/systems in tandem	Good
Proportional cost of the proposed system change		
Manager Proposing Change	<25% of the annual systems budget	Worst
Senior Manager 1	26% < annual systems budget <50%	Poor
Senior Manager 2	26% < annual systems budget <50%	Poor
Senior Manager 3	<25% of the annual systems budget	Poor
Senior Manager 4	<25% of the annual systems budget	Worst

Key

Impact of proposed change	Match with experience(or ROI)
Minimal impact	Best
some impact	Good
significant impact	Poor
Maximum impact	Worst

Figure 2-2: Example Chart for the Consensus of Change Characteristics

In visualising the "riskiness" of the proposed change then a "traffic lights" colour scheme (green, yellow, orange, red) is used.

- In the first column the "impact" of the change is evaluated and the colour identifies how significant the change is: green implies minimal impact/cost through to red which implies a fundamental impact or cost across the organisation.
- In the second column the match of experience to the change characteristic is evaluated and the colour identifies how close the match is: green implies the best match through to red which implies a worst match.

Therefore, in evaluating the change and its characteristics an organisation is essentially looking for

- green/yellow colours in the columns (indicating low risk) and
- close colour matches between senior managers (indicating consensus about the proposed change).

Once the decision is taken to go ahead with a change then the data collection phase of RAMESES begins.

3 Data Collection Component

The RAMESES method has 2 phases for data collection (as shown diagrammatically in Figure 3-1):

- Phase 1 concentrates on gathering data from the senior management team to audit and model their understanding of the business and it areas of IT support.
- Phase 2 concentrates on gathering data from the operational level staff to develop task trails detailing the business processes and map the precise nature of the IT supporting these.

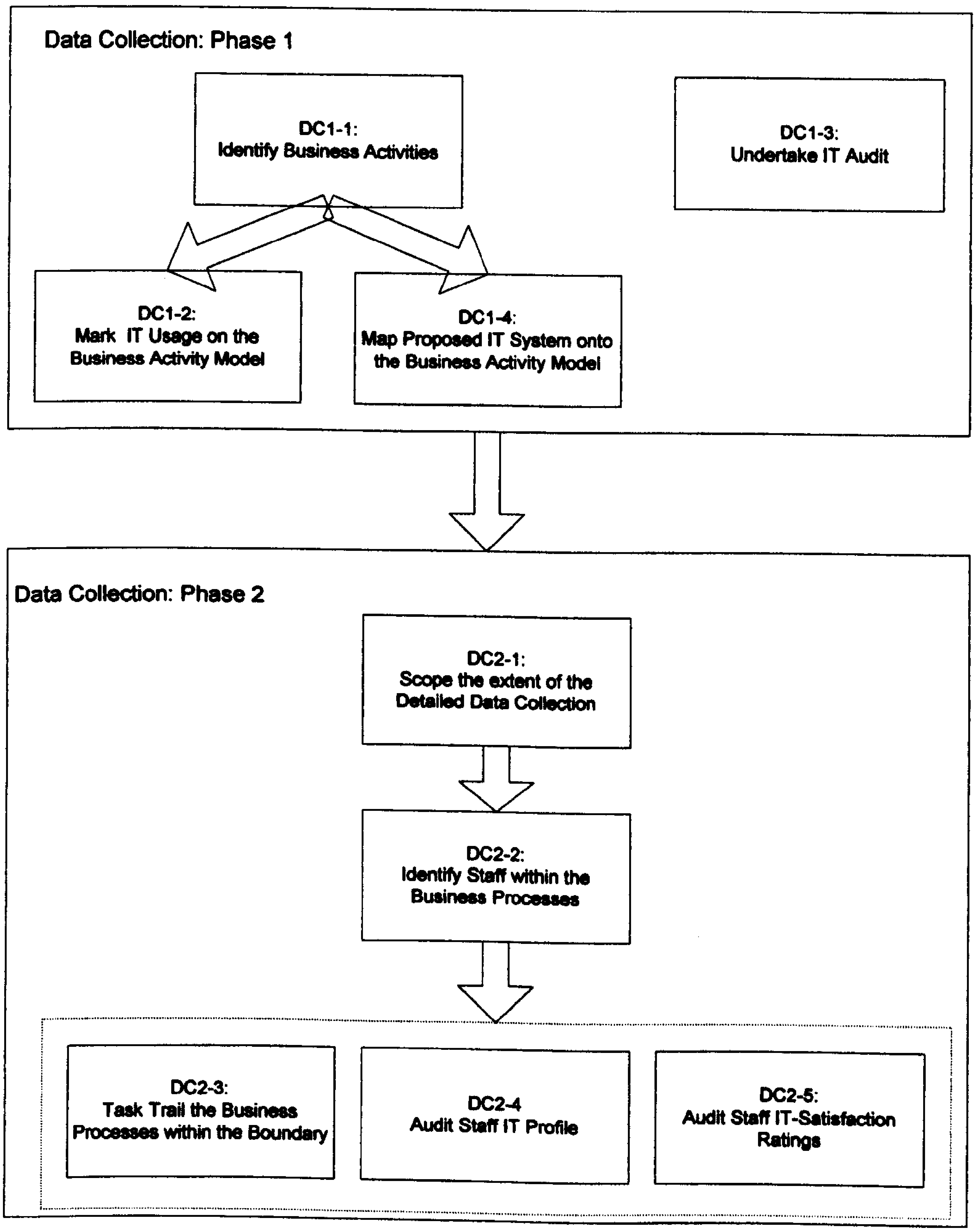


Figure 3-1: The Procedural Flow of the Data Collection Component

3.1 Data Collection Phase 1

3.1.1 Activity DC1-1: Identify Business Activities

This activity is undertaken by all senior managers within the organisation, starting with the MD/CEO.

The MD/CEO identifies the senior managers, their areas of responsibility, and whom they report to. This data is recorded on WP/DC1-1a.

The data is then used to construct a top level business activity model as shown in figure 3-2.

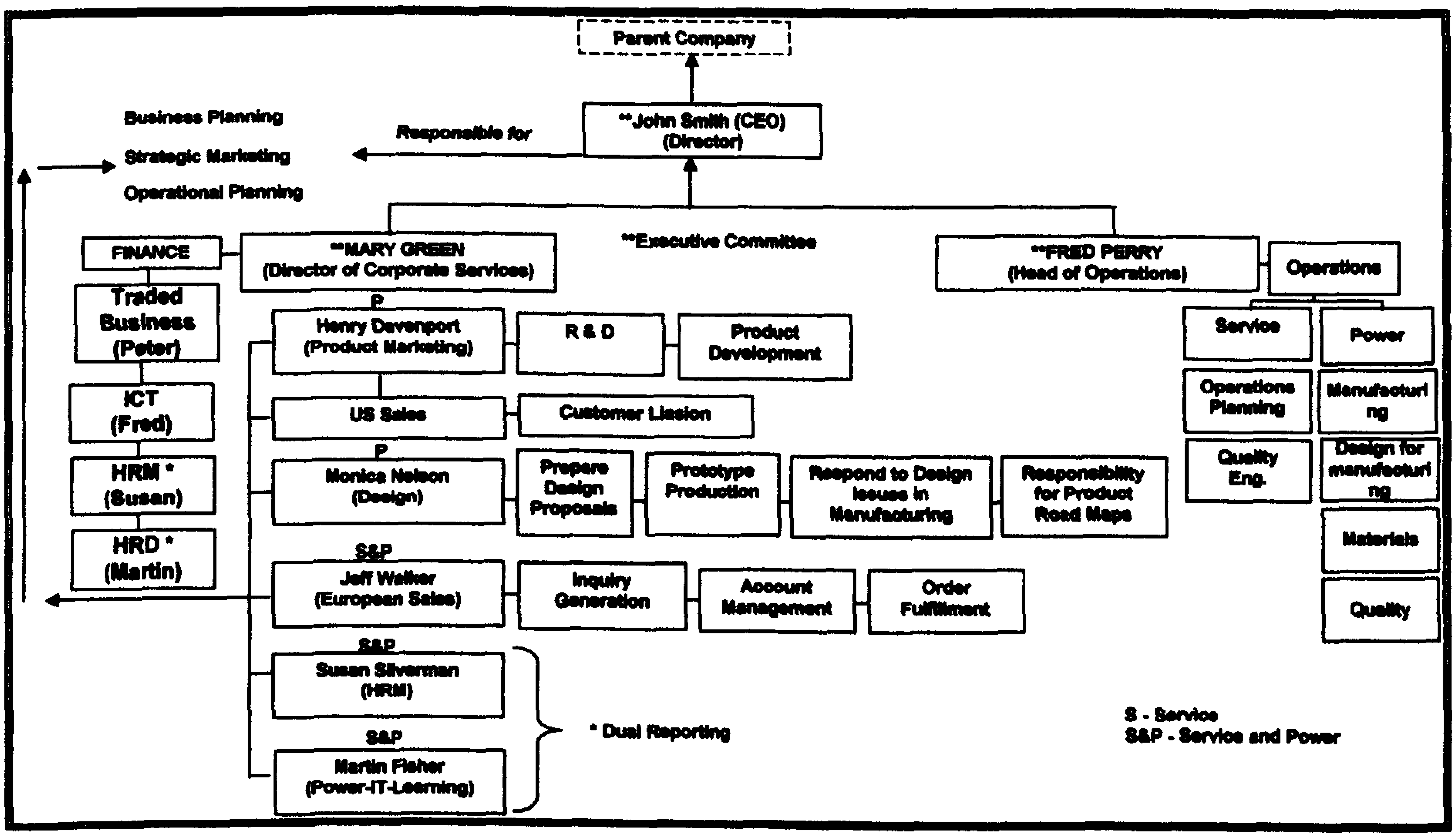


Figure 3-2: Example Top Level Business Activity Model (BAM).

Although it is only necessary (in terms of the risk assessment) to detail the relevant areas that relate to the **proposed** change it is a useful exercise to undertake this process throughout the organisation at least at this top level.

Once this map is produced each of the managers identified provides more details on the activity within their area of responsibility, including the supervisory staff with responsibility for those activities and the lines of reporting. This data is recorded on WP/DC1-1b and is used to construct a more detailed business activity model for their area. An example of a manager's model is shown in Figure 3-3.

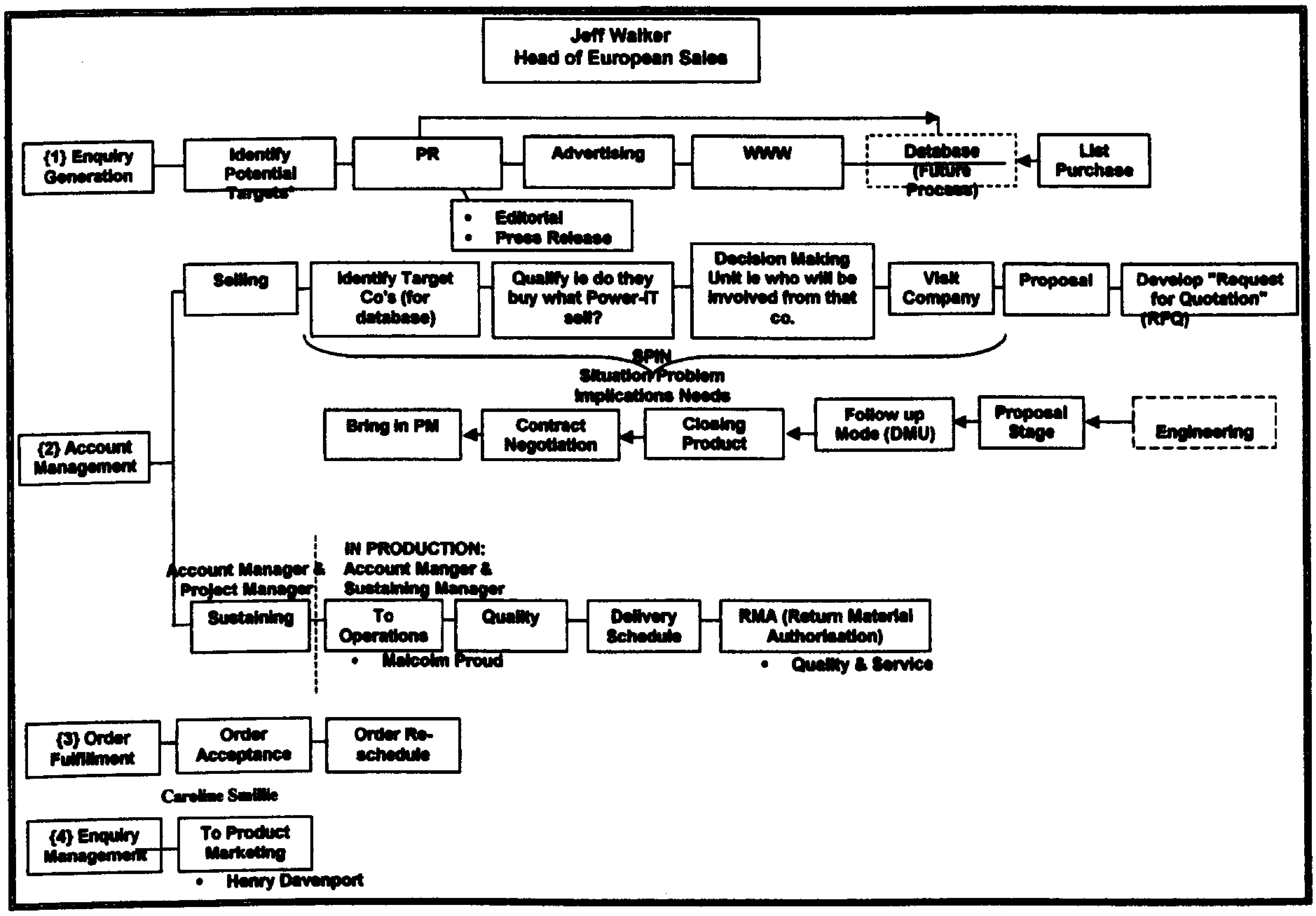


Figure 3-3: Example Business Activity Model (BAM) for Senior Manager with Responsibility for Eurpoean Sales.

This process allows a model to be constructed for the whole organisation. The models are fundamental for further data collection and analysis and are therefore essential within the RAMESES process.

Once the full Business Activity Model is constructed it is useful for the full SMT to review it to ensure no areas have been omitted.

To construct the top level Business Activity Model (BAM) the MD/CEO completes the workpack WP/DC1-1a.

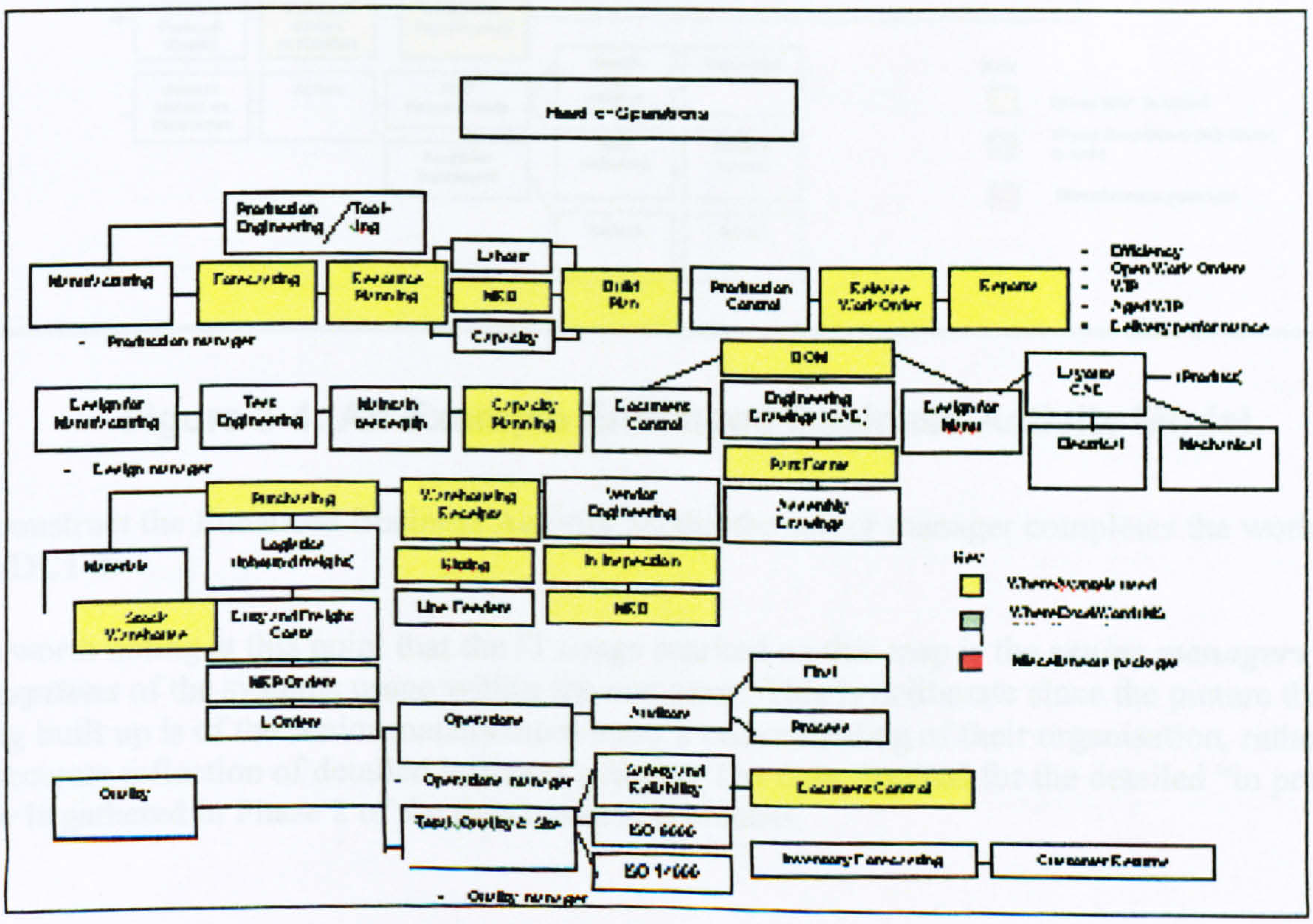
To construct the required detailed Business Activity Models (BAMs) each senior manager completes the workpack WP/DC1-1b.

3.1.2 Activity DC1-2: Mark IT Usage on the Business Activity Model

This activity is undertaken by all senior managers within the organisation. Each manager takes his set of workpacks WP/DC1-1b and adds the information about any IT that is known to be used in support of an activity. This additional detail is then used to enhance the business activity models by colour coding specific IT systems/packages against business activities. This enables the senior management team to have a visual representation of the organisation's reliance upon IT.

The benefits of this are, for instance, that it can easily be seen whether there is reliance throughout the company on one system, or conversely, whether many separate systems are used.

Figure 3-4 is an example of a completed Enhanced Business Activity Model (EBAM), where although three different IT systems have been identified within the organisation only one (as indicated by the yellow blocks) is used within the "Operations" area. It can also be easily seen from this model that much of the activity remains entirely manual.



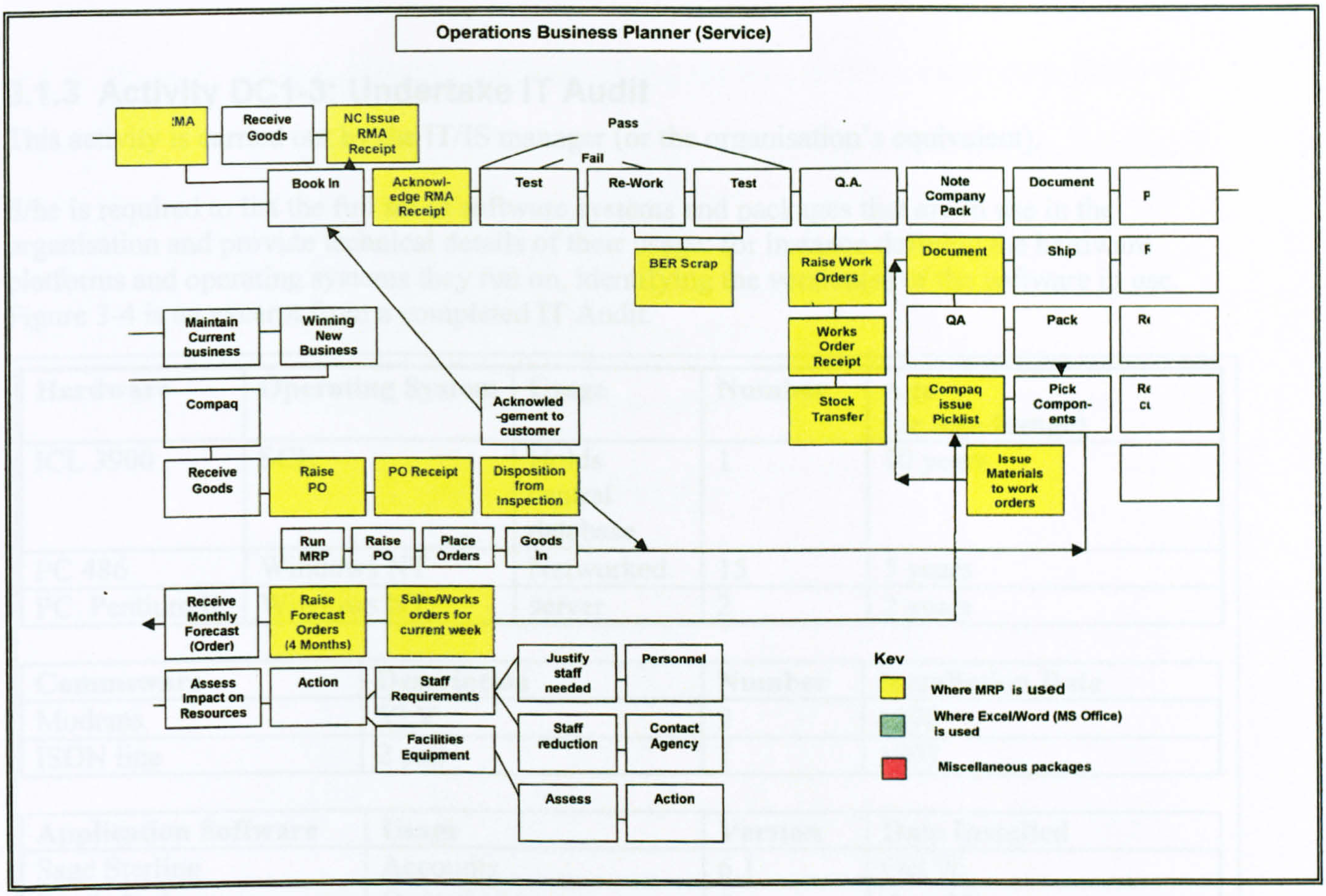


Figure 3-4: An Example Enhanced Business Activity Model.

To construct the Enhanced Business Activity Model the senior manager completes the workpack WP/DC1-2.

It is worth noting at this point that the IT usage marked on this map is the ***senior managers' perceptions*** of the systems usage within the company. This is deliberate since the picture that is being built up is of the senior management team's understanding of their organisation, rather than an accurate reflection of detailed business activity. The data required for the detailed "in practice" view is gathered in Phase 2 of the data collection process.

3.1.3 Activity DC1-3: Undertake IT Audit

This activity is carried out by the IT/IS manager (or the organisation's equivalent).

S/he is required to list the full set of software systems and packages that are in use in the organisation and provide technical details of their usage: for instance defining the hardware platforms and operating systems they run on, identifying the version(s) of the software in use. Figure 3-4 is an excerpt from a completed IT Audit.

Hardware	**Operating System**	**Usage**	**Number**	**Age (or Age Range)**
ICL 3900	SCL	Holds central database	1	10 years
PC 486	Windows NT	Networked.	15	5 years
PC Pentium II	Windows NT	server	2	2 years

Commsware	**Description**	**Number**	**Installation Date**
Modems	52.V	2	1998
ISDN line	2 pair	1	1997

Application Software	**Usage**	**Version**	**Date Installed**
Sage Sterling	Accounts	6.1	Oct 96
Fred's Estimator	Quotations	0	Aug 85

Communications Software	**Usage**	**Version**	**Date Installed**
Lotus Notes	interdepartmental	4.0	Oct 96
Microsoft Outlook	e-mail	1	June 98

Figure 3-5: Example Data Held within an IT Audit.

To record the results of the IT Audit the IT/IS manager completes the workpack WP/DC1-3.

3.1.4 Activity DC1-4: Map Proposed IT System onto the Business Activity Model

This activity is undertaken by a nominated representative of the senior management team. The business activity areas that are expected to use the proposed IT system area identified and the proposed IT system marked against them. This activity differs from the others in this phase in as much as they all focus on the current "as is" situation in the organisation whereas this activity moves the focus to the future by looking, at a high level, at the impact of the proposed system. This view of the business is termed the Proposed Business Activity Model (PBAM).

Figure 3-6 gives an example of a completed Proposed Business Activity Model (PBAM).

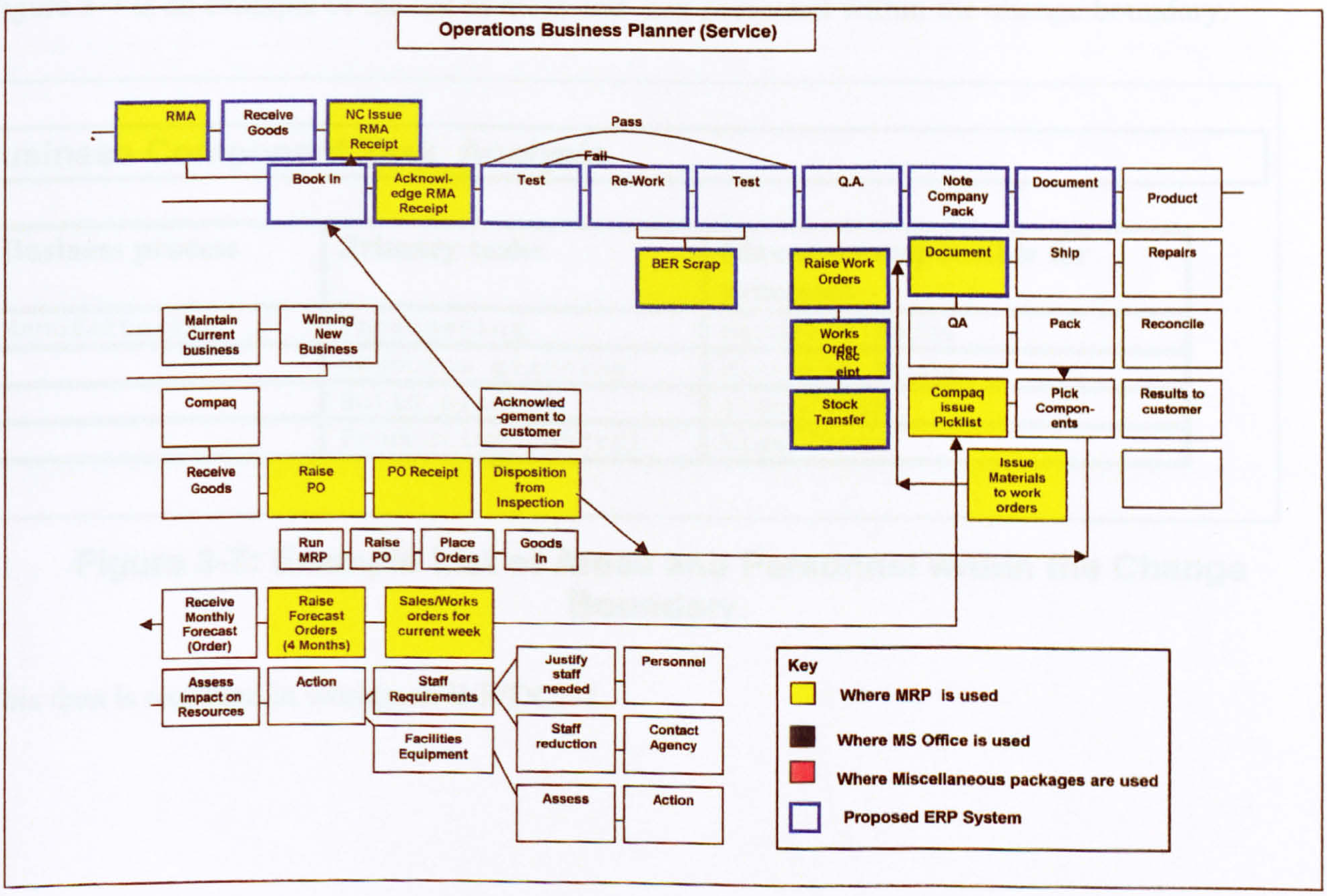


Figure 3-6: An Example of Proposed Business Activity Model (PBAM).

To construct the Proposed Business Activity Model the nominated representative completes the workpack WP/DC1-4.

This data is then mapped against the Extended Business Activity Model from step DC1-2. Again, it is worth noting at this point that the IT usage marked on this map is the ***senior managers' perceptions*** of the impact that the proposed system will have.

3.2 Data Collection Phase 2

3.2.1 Activity DC2-1: Scope the Extent of the Detailed Data Collection

The Proposed Business Activity Model (PBAM) derived in Activity DC1-4 is used to determine the scope (or boundary) for the more detailed data collection undertaken in Phase 2. The nominated representative identifies from the model all those business areas and personnel affected by the proposed system: these are included within the boundary.

Figure 3-7 is an example of the list of areas and key personnel within the change boundary.

Business Component Task Analysis

Business process	Primary tasks	Managers responsible for processes
Manufacturing	Forecasting	Michelle Young
	Resource planning	Michelle Young
	Build plan	Alan Jones
	Production control	Alan Jones

Figure 3-7: Example List of Areas and Personnel within the Change Boundary.

This data is recorded in workpack WP/DC2-1.

3.2.2 Activity DC2-2: Identify Staff within the Business Processes

The staff member identified as having day-to-day responsibility for an area within the boundary is required to

- identify the business processes within his/her area
- list the staff members active within these processes, and
- identify who is at the start of each process.

Figure 3-8 is an example of the personnel and tasks within a business process.

Business Process Component Name: Customer Order Placement

Named Staff with overall responsibility for the component: Bob Job

Task	Process Position	Employee's Name
Customer Enquiries	First	Janine Smith
Quotations		Edward Bearson
Costing		Samantha Clasper
Customer service		Luke Gerard

Figure 3-8: Example List of Personnel and Tasks within a Business Process.

This data is collected using workpack WP/DC2-2.

3.2.3 Activity DC2-3: Task Trail the Business Processes within the Boundary

Task trailing of a process can begin once a business process and (some of) the staff working within it have been identified. This is a critical feature of the RAMESES method, much of the analysis that can be done to evaluate the risk of change is reliant on the information collected here. Therefore, it is important that those completing the task trails understand the value of the information they provide and reasons **why** it needs to be collected.

The business process is constructed by documenting (on workpack WP/DC2-2) the individual tasks that are carried out.

- This documentation records: (i) the inputs to the task, (ii) the activity of the task and (iii) the outputs of the task.
- Additional information is collected so a profile can be built of : (i) **how** the input and output data are provided (ii) **by whom,** and (iii) whether **any** IT is used to support the task.

In this way the business process is built up from its task level components to reflect how it is carried out in practice.

The major advantage of this approach is that it allows "holes to be plugged". For instance, if the person with responsibility for the business process has left some staff involved in carrying out the process unidentified, this approach ensures that they are named by those liaising with them in the task trail (the receiver or producers of their data).

Figure 3-9 gives an example of a business process map that has been constructed using such data.

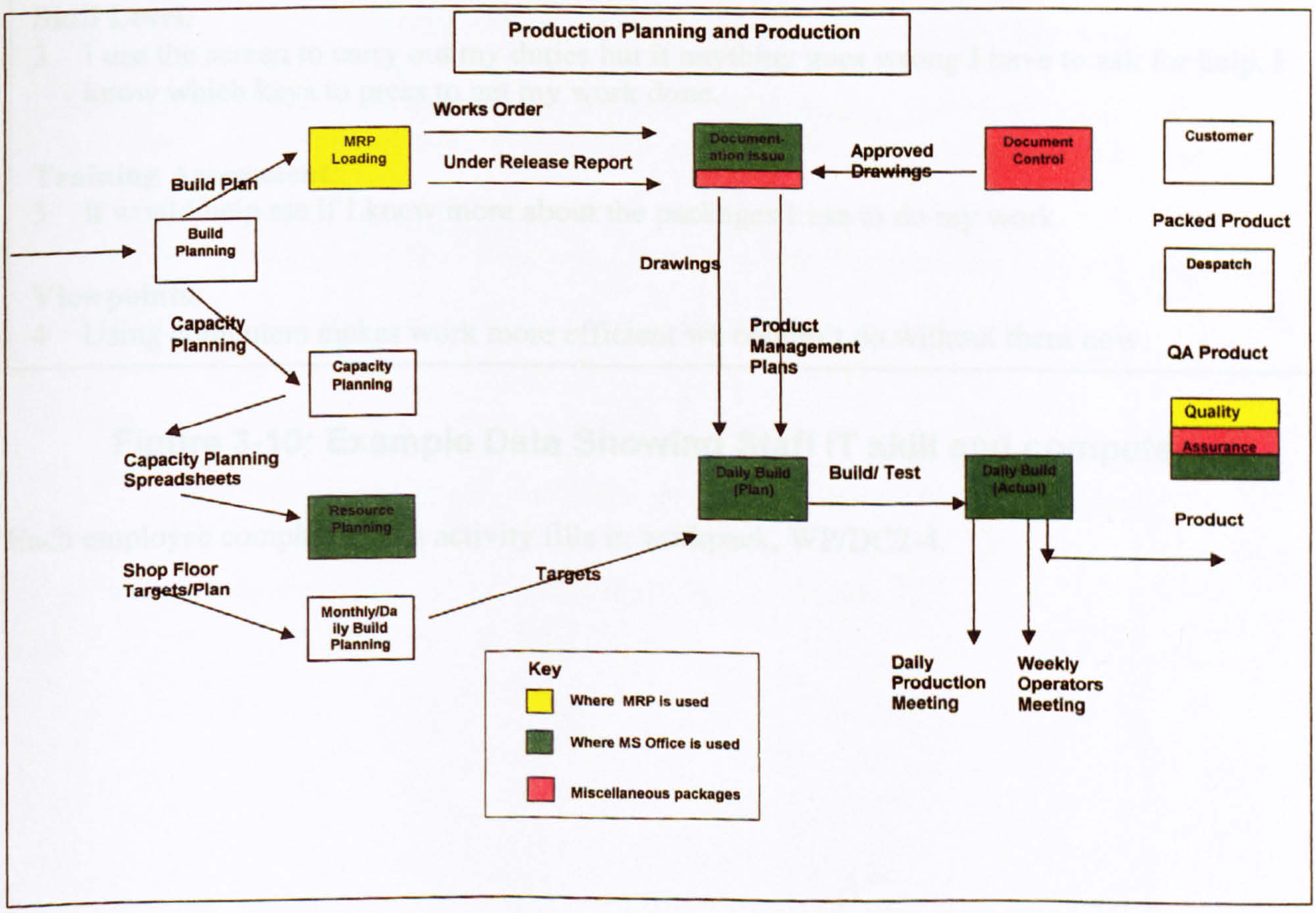


Figure 3-9: Partial Task Trail

3.2.4 Activity DC2-4: Audit Staff IT Profile

When an individual member of staff is contacted and asked to complete his/her task description (using workpack DC2-3) s/he is also asked to provide a profile of his/her IT skills, education and experience. This data is useful when assessing the staff competency and training needs for the proposed system.

Figure 3-10 provides an example of the data collected during this activity based on staff IT competency.

User Name: Siobhan Burns **Age:** 30

Position: Accounts Clerk **Length of service :** 5 years

Formal IT Qualifications/Training:

Examining Body	Level	Grade	Subject
	Entry		2 weeks training in Accounts-manager

Software That You Use:

Software Title	Task Name	Importance
Accounts-manager	Order reconciliation	High
MS-Excel	Order reconciliation	Medium

Skill Level:

3 I use the screen to carry out my duties but if anything goes wrong I have to ask for help. I know which keys to press to get my work done.

Training Assessment:

3 It would help me if I knew more about the packages I use to do my work

Viewpoints:

4 Using computers makes work more efficient we couldn't do without them now

Figure 3-10: Example Data Showing Staff IT skill and competency.

Each employee completing this activity fills in workpack, WP/DC2-4.

3.2.5 Activity DC2-5: Audit Staff IT-Satisfaction Ratings

When an individual member of staff is contacted and asked to complete his/her task description (using workpack DC2-3) s/he is also asked to provide a profile of his/her satisfaction with each IT system that s/he uses and his/her assessment of the how important this is in enabling him/her to complete the tasks. This data is useful when assessing the role that IT could/should play in the business process.

Figure 3-11 provides an example of the responses of a member of staff reflecting his satisfaction with a software application.

Use of IT in task: `Order Reconciliation`
The task is supported by:
(please name the software component name or enter "None)

`Account-Manager`

If task is supported by IT please answer the following questions, otherwise this section is complete:

The IT component is: `An independent package`

YOUR OPINIONS ABOUT THE USE OF THE SOFTWARE

1. Does the software help you to be productive in your work? `It is essential.`
2. In general, how would you describe the ease of use of the system? `Good`
3. How would you describe the screens you use with this software? (are they simple to understand and work through etc?). `Good`
4. Does the system provide the accurate and precise information you need? `Always`
5. To what extent are the outputs of the system actually used? (e.g. reports etc.) `Often`

SUPPORT FOR THE SOFTWARE

6. How would you describe the levels of support for this software within your organisation? `Fair`
7. How would you describe the quality of the system documentation? `Good`

Figure 3-11: Example Data Showing Staff IT-Satisfaction.

Each employee completing this activity fills in workpack, WP/DC2-5.

4 Analysis

There is little point in collecting data unless some use is made of it. Therefore, in the RAMESES method there is a set of tools that can be used to make comparative analyses of the data collected.

There is not a specific procedure governing **when** these tools should/can be used. What does determine whether they can be used is simply whether the data required as input has been collected. Therefore, in this section in the description of the tools the assumption is made that the necessary data sets exist. Diagrams are used in this section to highlight the data sets that are required for each tool. However, the time/location at which the tools may be used is shown more clearly in Figure 1-2 (the schematic view of RAMESES).

The data analysis is undertaken by comparing data sets to enhance the understanding of the proposed change. Data sets are paired for the purpose of comparison. Multiple pairings can be undertaken dependent on the change scenario under investigation. The data analysis can be undertaken at differing levels of detail according to the context of the change.

For each analysis tool this section details firstly the data pairs required, and secondly, the detailed enhancement of those data sets.

4.1 Analysis Tools focusing on the Business Activity

4.1.1 Analysis Tool A-1: Compare IT Usage: Proposed against Existing.

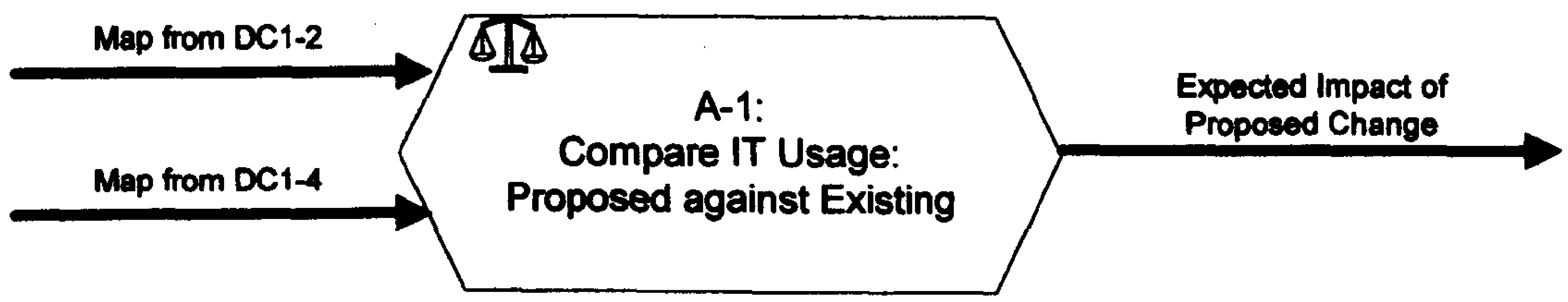


Figure 4-1: Summary of the Analysis Tool A-1

This analysis activity provides an overview of the organisation's *perceived* level of current IS presence across the business processes under investigation. This view is compared with the *perceived* impact of the proposed change in a visual representation.

The key factor to observe is the degree to which business activities are supported by single or disparate systems. The questions to be answered by this diagram are:

- how many system components will be impacted by the proposed change?
- To what degree are the organisation's business activities impacted by the proposed change?

The analysis is conducted in the following manner:
- The information from maps DC1-2 and DC1-4 is entered onto a grid to identify the location of software elements within the business processes.
- The level of usage within the processes is also highlighted in terms of the number of users within each process using the existing software.
- Two grids are constructed to show the difference between the perception of the *existing* and the *proposed* systems.
- The differences in the expected usage are identified via the "user numbers".

Figures 4-2 and 4-3 below provides a diagrammatic representation of this analysis process.

One of the main outcomes of this analysis (from comparing Figures 4-2 and 4-3) is that:
- The usage of the proposed ERP system shows a significant increase in user numbers.
- This could be expected to impact upon training needs since new users may not have the required skill set, and therefore additional training may need to be incorporated into the implementation.

Existing IT system usage against Business Activities(identifying numbers of users)

	MRP system	CAD/CAM	Microsoft Office	Quotations Package
Quotation	2	1	7	1
production planning	2	1	3	1
production	2		3	
Customer order placement	4		3	
Customer returns	3		8	
despatch	5		5	
warranty returns	2		2	
purchasing	1		1	
Sales	1		1	
invoicing	1		3	

Number of users per software element

MRP System	23
CAD/CAM	2
Microsoft Office	34
Quotations Package	2

Figure 4-2: Intermediate Output of Tool A-1 for Existing System

This example shows the *perceived* impact of the existing system on the existing business process in terms of the system components. The system components are the individual pieces of software which support the business in fulfilling the processes.
Four key software elements are identified and the number of users are shown within each process. The primary software elements in use are: An MRP system, MS Office, a Quotations package and CAD/CAM. Where:

- Microsoft Office is used to fill gaps in the existing MRP system as well as providing general office support.
- The Quotations package and CAD/CAM are crucial to the business processes upon which they impact as part of the quotation and production planning processes.

Figure 4-3 shows the location of the *proposed* system against the existing business processes.

The proposed system is an ERP system which is to replace the existing MRP system software. The new system is intended to be to a complete replacement for the MRP system: consolidating the functionality currently supplied by Microsoft Office. Microsoft Office will continue to provide general office support for the user base.

The diagram supports this notion by indicating that the ERP system replaces the MRP system and is located alongside Microsoft Office to provide full support. CAD/CAM and the Quotations package are design packages that are integral to the business processes as identified but will not be impacted by the proposed implementation.

Comparison of proposed IT System usage against Existing IT system usage

	MRP System	CAD/CAM	Microsoft Office	Quotations Package
Quotation	6	1	7	1
production planning	7	1	3	1
production	7		3	
Customer order placement	6		3	
Customer returns	15		8	
despatch	7		5	
warranty returns	4		2	
purchasing	2		1	
Sales	4		1	
invoicing			3	

Number of users per software element

ERP system	63	Microsoft Office	34
MRP system	0	CAD/CAM	2
		Quotations Package	2

Figure 4-3: Output of Tool A-1 Showing Impact of Proposed System

The resultant grid in Figure 4-3 for the usage of the proposed system (the ERP system) shows a significant increase in user numbers. This could be expected to impact upon training needs since new users may not have the required skill set. Therefore, additional training may need to be incorporated into the implementation. This aspect is analysed more explicitly using tool A-5.

4.1.2 Analysis Tool A-2: Compare Existing IT Usage: Perceived against Detected.

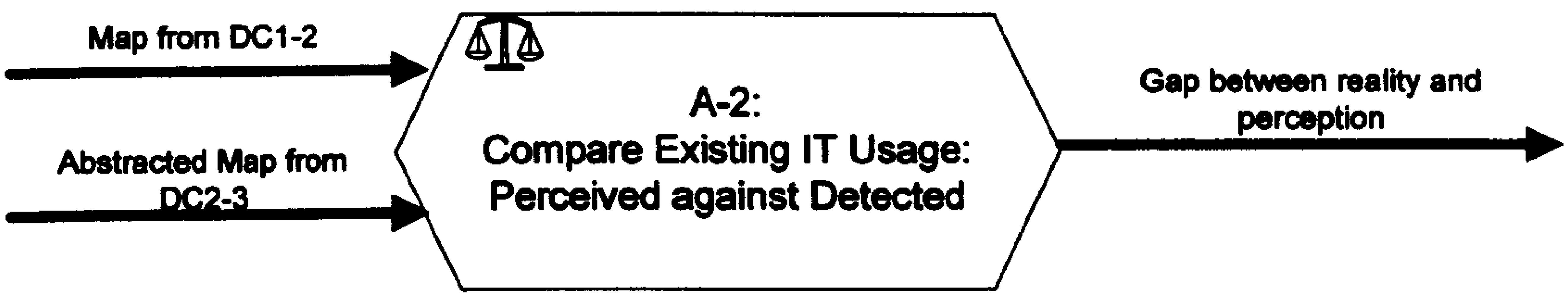


Figure 4-4: Summary of the Analysis Tool A-2

This analysis activity compares the organisational *perception* of the *existing* IT system with the *detected actual* system in use across the business activities.

The primary factor in this exercise is to identify the degree of accuracy in the managerial perception of the system against its actual impact.

The basic question to be answered by this diagram set is:
- To what degree is the system acting as it is understood by the management team?

This view may identify, for instance:
- "workarounds" where the users have found novel solutions to system inadequacies
- more intensive usage than a high level understanding would have expected.

The analysis is conducted in the following manner:
- The information from maps DC1-2 and DC2-3 is entered onto a grid to identify the location of software elements supporting tasks within the business process.
- The level of usage within each task is also highlighted in terms of the number of users within each task using the supporting software.
- Differences in *expected* usage are identified via the user numbers.

The grid shows the actual software in use against the managerial perception of software in use.

Figure 4-5 shows an example of this analysis process. This shows the analysis between the actual system usage within the production planning process and the perceived managerial view of system usage.

From this analysis we can see that
- there is a higher system impact than is perceived by the manager, and
- the managerial perception of which software supports the system is inaccurate.

Detected v. Perceived System Usage

Production Planning	Actual software usage	Perceived software usage
Forecasting	2	1
Resource planning	2	1
MRB	2	1
Labour	4	1
Capacity	3	1
Build plan	5	1
Production control	2	1
Release works orders	1	1
Reports	1	1
Microsoft Office	7	
MRP system	6	8
Manual Task	5	1

Figure 4-5: Comparison of perceived existing IT usage against detected IT usage

4.1.3 Analysis Tool A-3: Compare IT Usage: Proposed against Detected.

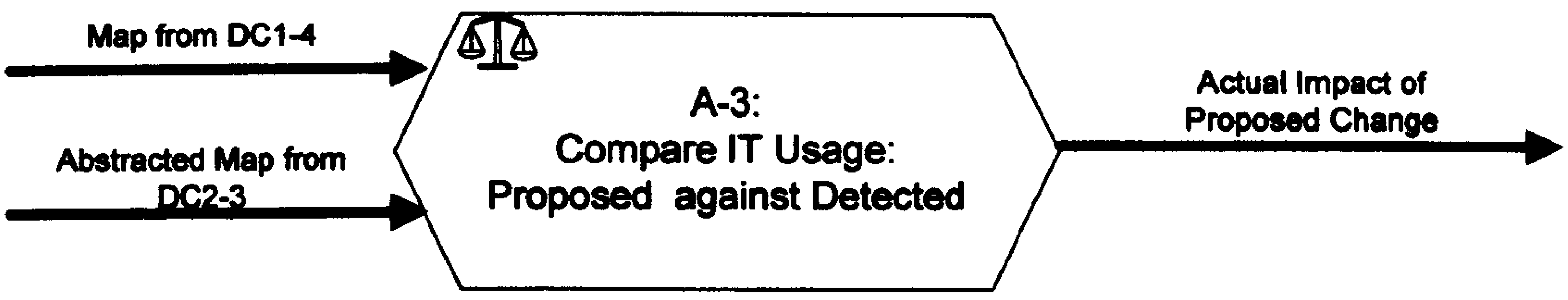


Figure 4-6: Summary of the Analysis Tool A-3

This analysis reveals the scale of the proposed change from what is *really used* and what is proposed.

The key feature considered here is the scale of the proposed change. A system may be proposed where IS support ranges from complete coverage from an individual piece of software to coverage of a business activity which is carried out entirely in a manual fashion.

The questions to be answered by this comparison are:
- How much of the business activity is currently supported by an IT system(s)?
- How does that differ from the system proposal?

The analysis is conducted in the following manner:
- The information from map DC2-3 is entered onto a grid to identify the location of software elements currently supporting tasks within the business process.
- The information from map DC1-4 is superimposed onto this grid to identify the location of the proposed IT system in supporting tasks within the business process.
- The resultant, populated, grid allows visual analysis of proposed and existing software support.

The level of abstraction of the grid is at the discretion of the decision makers, it can be a coarse grid (for instance, focusing on departmental support) or a fine mesh (for instance, focusing at the level of individual task support).

Figure 4-7 shows an example grid resulting from this analysis process.

From this analysis we can see that
- All tasks that are currently supported by software are have support from the proposed IT systems, and
- Some (although not all) of the tasks that are currently undertaken manually will be supported by the proposed IT system.

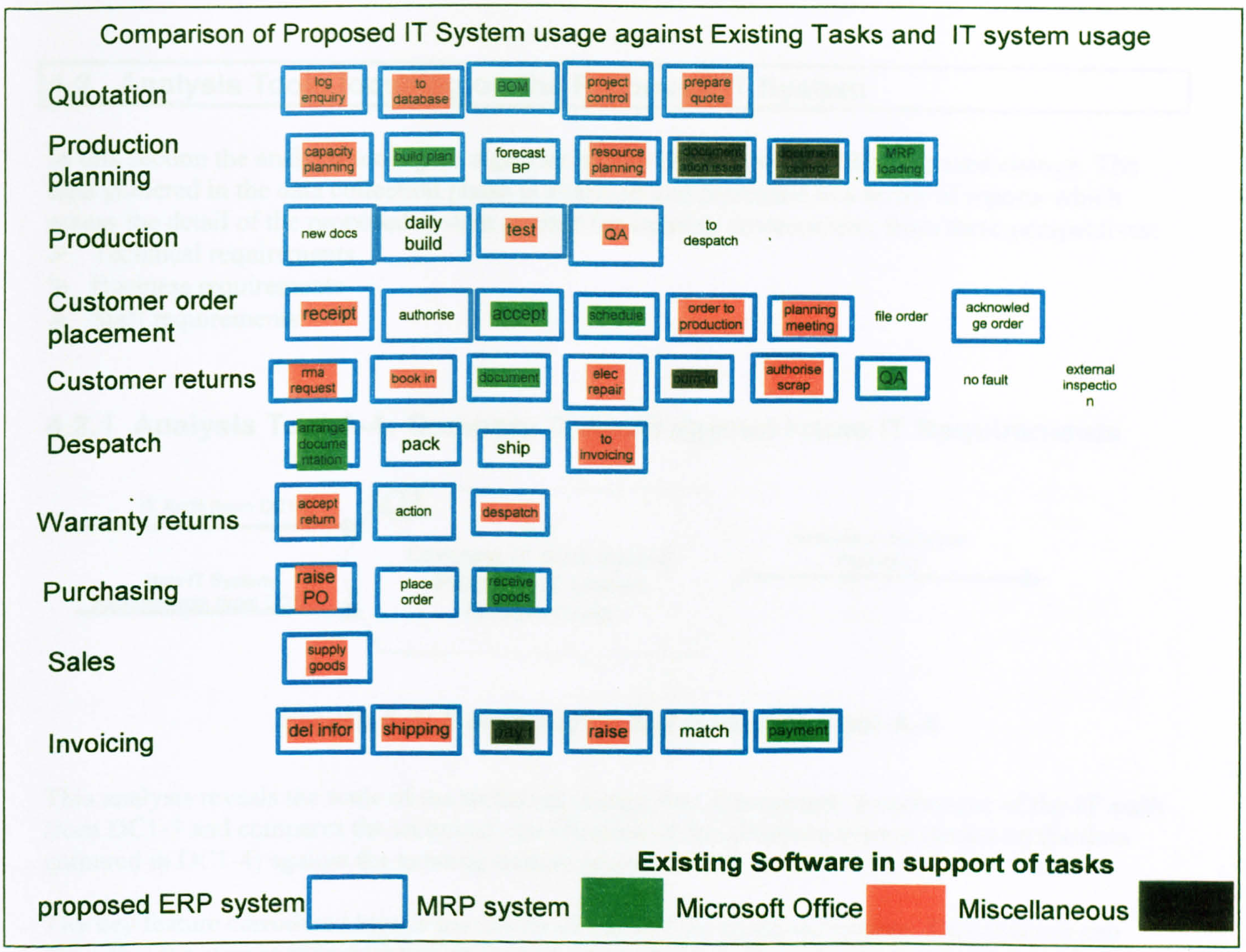


Figure3-7: Grid showing Impact of Proposed Systems on Current Tasks and Systems

4.2 Analysis Tools focusing on the Proposed IT System

In this section the analysis tools give a greater insight into the scale of the proposed change. The data gathered in the data collection phase is analysed and presented in a series of reports which assess the detail of the proposed system against the existing environment, from three perspectives:
- Technical requirements
- Business requirements
- Staff requirements

4.2.1 Analysis Tool A-4: Compare IT Audit against future IT Requirements

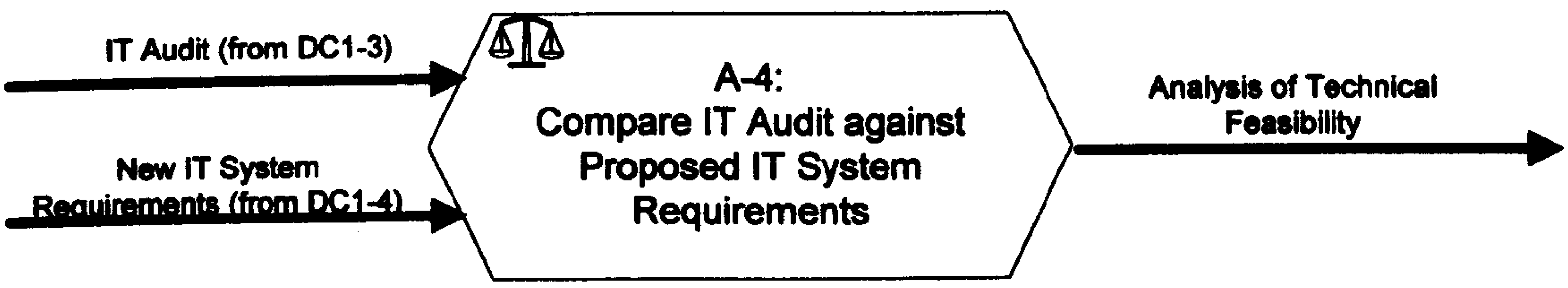


Figure 4-8: Summary of the Analysis Tool A-4

This analysis reveals the scale of the technical change that is proposed. It makes use of the IT audit from DC1-3 and compares the technical specification of the proposed system (based on the data gathered in DC1-4) against the existing infrastructure.

The key feature considered here is the ability to support the proposed system. This analysis can show that the current infrastructure needs to be upgraded to support the preferred system. Or may be used in a tendering process to identify those proposed systems that can run in the current environment.

The questions to be answered by this comparison are:
- Can the current infrastructure support the proposed system?
  - Will investment need to be made to upgrade?

or
- Do the potential suppliers' products fit with our infrastructure?

The analysis is conducted in the following manner:
- The technical requirements of the current system are described in terms of the range of existing hardware (and operating system).
- The hardware (and operating system) requirements of the proposed system are stated and compared against the current IT.
- Recommendations are made as to the potential utility of the existing infrastructure

The collation of IT audit data must be consistently carried out if this analysis is to be possible. Data matching the specification of the proposed system requirements is essential for this analysis to be undertaken. Peripheral hardware should also be assessed e.g. printers, modems, CD drives and the network specification. Compatibility between operating systems is also a crucial factor it is essential that this factor is taken into consideration.

Figure 4-9 shows an example report resulting from this analysis process.

PROPOSED SYSTEM RECOMMENDATIONS	
Technical System Detail - Recommended Minimum System Hardware and O/S: PC. Processor: Pentium, P75 RAM: 32Mb Hard drive: 1Gb O/S: Windows NT, 2000, 98	
Current Infrastructure	**Impact on proposed change**
15 PCs with specification: Processor: 386sx33 RAM: 8Mb Hard drive: 120Mb O/S: Windows 95 or above	These PC's are unsuitable hardware to support the proposed system, they lack both speed and RAM and therefore require replacing, as for such old machines updating is not a consideration.
12 PCs with specification: Processor: 486DX66 RAM: 16Mb Hard drive: 420Mb O/S: Windows 98 or above	These machines are below the recommended minimum. However it may be worth increasing RAM to improve operational speed, upgrading the hard disks and upgrading to Windows NT. These machines would be best utilised for data entry where processing will not impact upon performance.
7 PCs with specification: Processor: 486DX4100 RAM: 32Mb Hard drive: 600Mb O/S: Windows NT or above	These machines could be utilised for data entry operations: additional hard disk space may be required.
19 PCs with specification: Processor: Pentium P75 RAM: 64Mb Hard drive: 1Gb O/S: Windows NT or above	These will adequately support the proposed software.

Figure 4-9: Example Report Showing Fit of Current Infrastructure to Proposed System Technical Requirements

From this analysis we can see that a substantial investment in new hardware is required to support the proposed changes. The following factors support this statement,

- 15 machines require direct replacement,
- 12 machines require upgrades and
- 7 machines would benefit from upgrades.

Investment will also be required to support the expected increase in the numbers of users. A phased investment strategy for hardware would be possible if an evolutionary approach to the implementation is practical and adopted.

4.2.2 Analysis Tool A-5: Business Feature Analysis for Future IT System

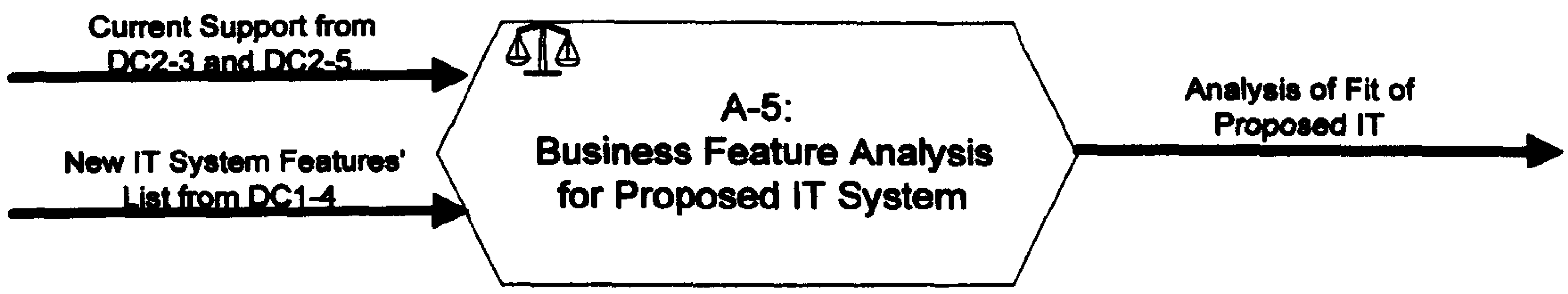


Figure 4-10: Summary of the Analysis Tool A-5

This analysis reveals the scale of the technical change that is proposed. It makes use of the IT audit from DC1-3 in terms of business activity support and compares the business features of the proposed system against the existing software infrastructure.

The key feature considered here is the ability of the proposed system to support the business requirements. This analysis can identify the current business needs being supported by existing IT solutions the compared to the preferred system. Or may be used in a tendering process to identify those proposed systems that fulfil the business needs in the current environment.

The questions to be answered by this comparison are:
- Can the proposed system meet the business requirements?

or
- Which potential suppliers' products offer the best fit with our business requirements?

The analysis is conducted in the following manner:
- Identify business needs from DC1-3 and DC2-5
- Identify a range of actions
- Compare business requirements against proposed system and assess against actions and fulfilment.

In this analysis detailed assessment of the business needs is required. Needs should be categorised from critical, meaning that they are essential to the business, to desirable which means that it would be a good feature to have and may offer some improvement to output, but is not fundamentally required to support the business. If the process is being undertaken to identify potential suppliers then the best fit will be achieved with the system that fulfils the highest number critical requirements.

Figure 4-11 gives an example of an extract from a detailed and substantive report on the assessment of the current system and the requirements for a system upgrade (the proposed change). For this particular case the upgrade of the system was essential to fulfil a critical and specific business need and therefore, in practice, it could leave other needs unfulfilled. However, each business need (gathered in the data collection phase) was assessed against the upgrade specification to identify whether they too could be fulfilled. The example is an illustration of the analysis tool. However, each report generated will be specific to the organisation and proposed change being undertaken.

The data collected within the workpacks supports this process, and a variety of reports can be constructed from this data. Such reports can be used to:

- Analyse how well tenders fulfil the requirements of the proposed system.
- Specify explicitly the business needs.
- Assess the adequacy of system support for business.

System Requirements Report for the Accounts Department

The following business needs have been identified within the Accounts Department.

1. It would be useful if information was provided immediately it becomes available. This is currently not possible because of the updates that are required.
2. "Traded" should report in US dollars, the system only allows reporting in one currency and there are two aspects of accounts - manufacturing and traded.
3. The system does not allow FIFO, there is only one process allowed. This has created more work and shows the inflexibility of the system. It would be useful if this was amended.
4. On the basic Profit and Loss Sheet the system is limited in the sense that expenses are written as codes. Therefore cross-referencing is necessary. Changes in this screen would be more time saving.
5. It would be useful if the opening balance is seen as cumulative, like in the old system, where you could see monthly movement on expenses. Currently it is not.

The following range of actions for dealing with the system have been identified:

1. System modification
   a) Extensive programming requirement (external budget over £1500)
   b) Limited programming requirement (external budget under £1500)
   c) Internal capability to execute change
2. Available within the system but not yet implemented (resource deficiency)
3. System bug (repairable through upgrade)
4. Changes implemented using training procedures.
5. No change possible.

Business Needs	Action	System Specification
1. It would be useful if information was given immediately…	Type 5 Comment: The summation/ posting routine is hindered if errors arise in a/c coding.	Spec no. 32 marked essential
2. "Traded" should report in US dollars, the system only allows reporting in one currency …	Type 1b	Spec no. 25 marked critical
3. The system does not allow FIFO, there is only one process allowed ...	Type 2 Comment: This can be handled with 'traceability' although this requires development.	Spec no. 14 marked critical
4. On the basic Profit and Loss Sheet the system is limited in the sense that expenses are written as codes …	Type 1b/1c Comment: Further clarification of this is needed.	Spec. no 34 marked desirable
5. It would be useful if the opening balance is seen as cumulative …	Type 1b/1c Comment: Report-writer package may offer route to fulfil this need.	Spec no. 25 marked critical

Figure 4-11: Example Report Showing Fit and Importance of Business Support to Current Business Activities

4.2.3 Analysis Tool A-6: Staff Competencies and Impact on Future IT System

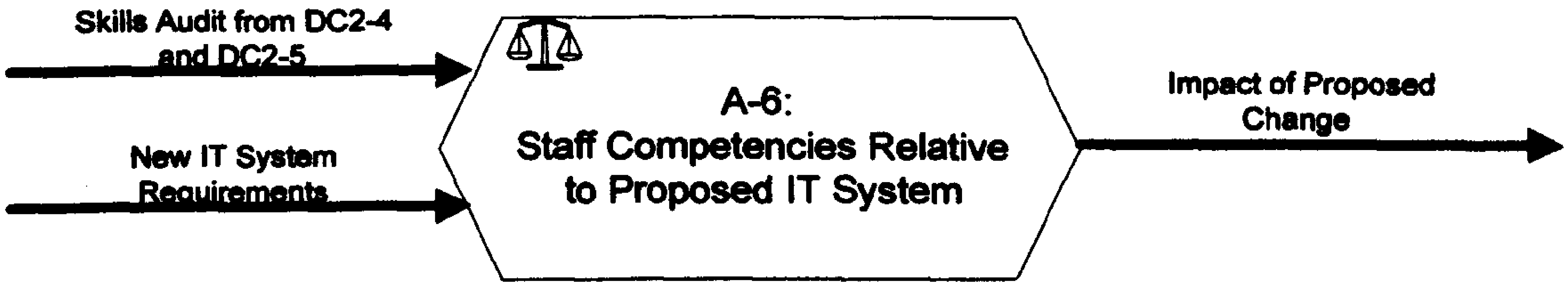


Figure 4-12: Summary of the Analysis Tool A-6

This analysis reveals extent to which the staff can be expected to cope with the proposed change. It helps to identify where particular training may be required. It also looks at how satisfied and competent the staff are with the current system. This can give an insight into how the deployment of the new system should be done.

The key feature considered here is the impact of the proposed change on the working practices of staff and analysis of how it can be most effectively deployed to gain staff satisfaction and competency. Often perfectly adequate systems fail in organisations because they are not accepted by their users.

The questions to be answered by this comparison are:
- how satisfied are staff with the current system?
- which aspects currently cause them difficulty?
- How do the features in the proposed system match with existing staff competency.
- Where should the focus be for training and support (e.g. user manuals, help systems) in the proposed system.
- Are these requirements built into the proposed system specification?

The analysis is conducted in the following manner:
- Summarise staff satisfaction ratings against existing software components within specific business processes.
- Summarise staff profiles against specific business process.
- Compare staff skills profiles against existing software components and proposed system.

This analysis helps to build reports rating the staff training/experience/confidence etc. this is then used to evaluate the features of a proposed system to look for mismatches (implying a training need for instance which may need to be built into any contract), or matches (implying good fit). Where staff viewpoints show motivation and enthusiasm for computer systems these individuals can be considered for roles as "champions" for the deployment. Having enthusiasts in a group (particularly with relevant skills) can be important for overcoming "resistance to change".

Figures 4-13 and 4-14 show example grids resulting from this analysis process.

Figure 4-13: Example Report Showing Staff Competencies Against Proposed Systems

Figure 4-14: Example Report Showing Staff IT Satisfaction Against Current Systems

5 Risk Gauges

The decision to make change is always going to remain with those running the organisation. However, the analysis tools in part 3 and the risk gauges in this part can help to inform this decision.

In this section two simple risk gauges are defined which can be used at any time during the RAMESES/decision-making process. They are like thermometers taking a patient's temperature at different time to confirm whether the previous diagnosis and proposed treatment seems to be still relevant.

5.1 Risk Gauge RG-1: Change Consensus

This gauge simply requires all those on the senior management team to calibrate their agreement with the need for the proposed change. If there is consensus then progressing the issue is sensible. If there is a lack of consensus a sensible plan would be to abandon the proposed change until the justification for it is accepted by the team as sufficient.

The change consensus is measured by all those on the senior management team completing workpack WP/ICC, a simple report is produced to show the level of agreement, as shown in Figure 5-1.

Identified change:

`Implementation of new ERP system to replace packages currently used with an integrated solution`

Justification of need for change:
Our system is out of date and difficult to maintain
and
We know we are not operating at best efficiency and wish to investigate further.

Consensus among SMT:

Strongly Agree	2
Agree	1
Don't know/ No view on the proposed change	1
Disagree	0
Strongly Disagree	0

Figure 5-1: Example Report Showing Change Consensus among the Senior Management

5.2 Risk Gauge RA-2: Change Context

This gauge simply requires analyses the proposed change in light of the experience and expertise of the organisation is shown in Figure 5-2. This data is gathered by using WP/CC. It can be used at any point within the RAMESES process. However, it is initially used at the beginning of the method to determine whether there is any point in pursuing the idea of change: and to highlight the expected level of risk.

	Expected Impact	Match with experience
Time scale of proposed system change		
Manager Proposing Change	Within 1 month	Poor
Senior Manager 1	Within 6 month	Best
Senior Manager 2	Within 6 month	Best
Senior Manager 3	Within 6 month	Best
Senior Manager 4	Within 6 month	Best
Scale of the proposed system change		
Manager Proposing Change	51% to 75%	Good
Senior Manager 1	51% to 75%	Good
Senior Manager 2	51% to 75%	Good
Senior Manager 3	76% to 100%	Poor
Senior Manager 4	51% to 75%	Good
Nature of the proposed system change		
Manager Proposing Change	Completed within a fixed period of time	Best
Senior Manager 1	Gradual implementation/systems in tandem	Good
Senior Manager 2	Completed within a fixed period of time	Best
Senior Manager 3	Gradual implementation/systems in tandem	Good
Senior Manager 4	Gradual implementation/systems in tandem	Good
Proportional cost of the proposed system change		
Manager Proposing Change	<25% of the annual systems budget	Worst
Senior Manager 1	26% < annual systems budget <50%	Poor
Senior Manager 2	26% < annual systems budget <50%	Poor
Senior Manager 3	<25% of the annual systems budget	Poor
Senior Manager 4	<25% of the annual systems budget	Worst

Key

Impact of proposed change	Match with experience(or ROI)
Minimal impact	Best
some impact	Good
significant impact	Poor
Maximum impact	Worst

Figure 5-2: Example Chart for the Consensus of Change Characteristics

In visualising the "riskiness" of the proposed change then a "traffic lights" colour scheme (green, yellow, orange, red) is used.

- In the first column the “impact” of the change is evaluated and the colour identifies how significant the change is: green implies minimal impact/cost through to red which implies a fundamental impact or cost across the organisation.
- In the second column the match of experience to the change characteristic is evaluated and the colour identifies how close the match is: green implies the best match through to red which implies a worst match.

Therefore, in evaluating the change and its characteristics an organisation is essentially looking for

- green/yellow colours in the columns (indicating low risk) and
- close colour matches between senior managers (indicating consensus about the proposed change).

6 RAMESES and Systems Procurement

There are three common ways that organisations procure systems:

- Invitation to tender.
- Buying off-the-shelf packages.
- Developing systems within the organisation.

For each there are benefits and drawbacks. But RAMESES can be used within each approach to help managers have confidence that they are looking for the right system, that it is needed and will fit within the organisation.

Once a system is deployed within an organisation then the use of RAMESES is focused at the maintenance, replacement or upgrading of systems.

Each of the three procurement approaches is looked at in turn to see how RAMESES should be used within them. Then the use of RAMESES within the maintenance phase is outlined.

6.1 Invitation to tender.

Within this approach the expectation is that an organisation will:

1. Identify a business activity that needs system support.
   - Undertake a feasibility study.
   - Create an "invitation to tender".
2. Evaluate an number of tenders to produce a short list of vendors
   - Using the vendors' submitted features list.
3. Choose a vendor's system: identify winning tender
4. Produce a detailed specification.
   - Draw up contract with vendor: Identify technical features, training requirements, support, upgrade policy etc.
5. Roll-out the system: Have the system installed on-site, with planned training and support.

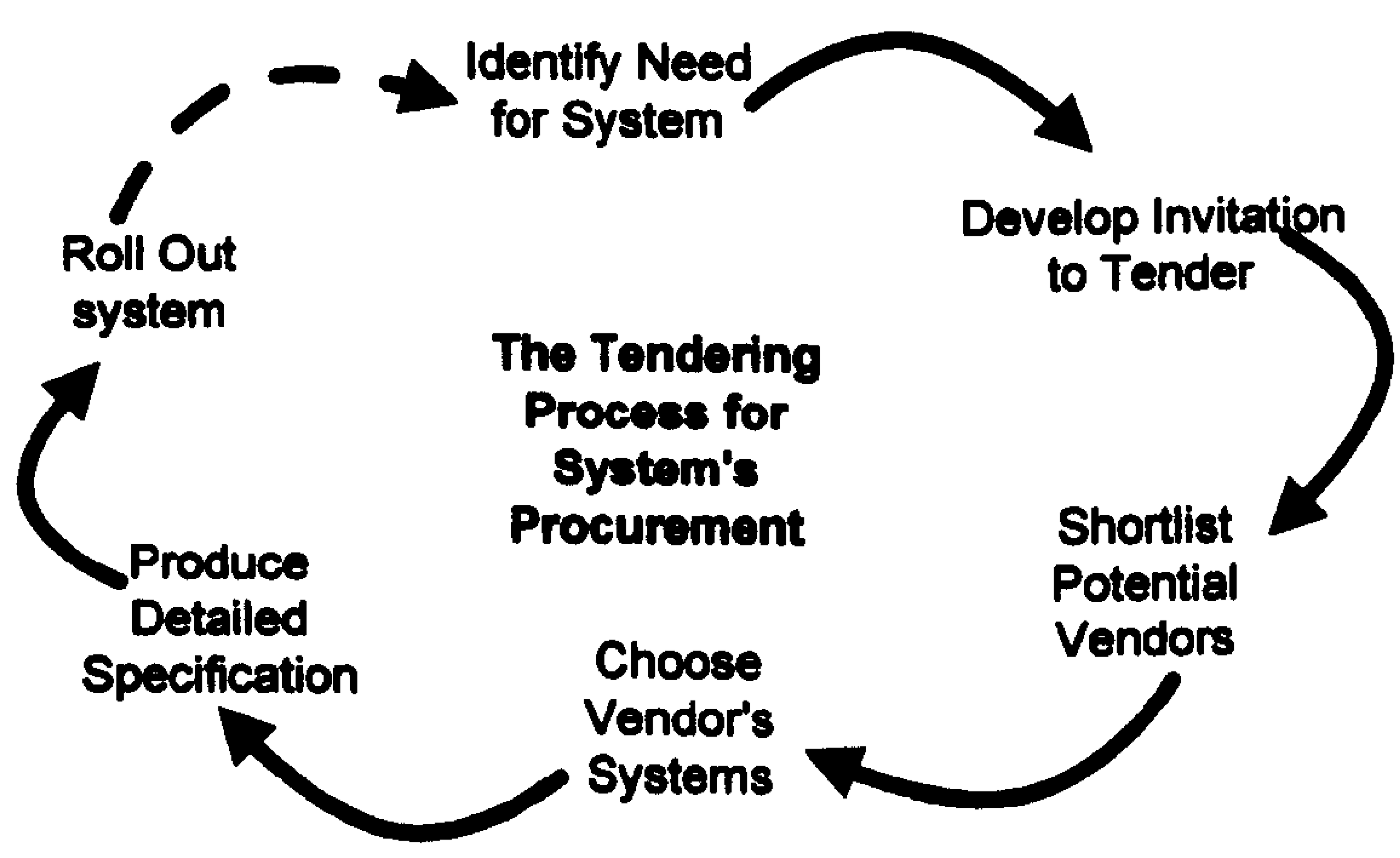


Figure 6-1: The System Tendering Lifecycle

In addition to these initial procurement activities organisations may also:

6. Undertake periodic system assessments: to evaluate how good the fit is between their expectation and the delivered system.
7. Identify the need for upgrades and evolution of the system.

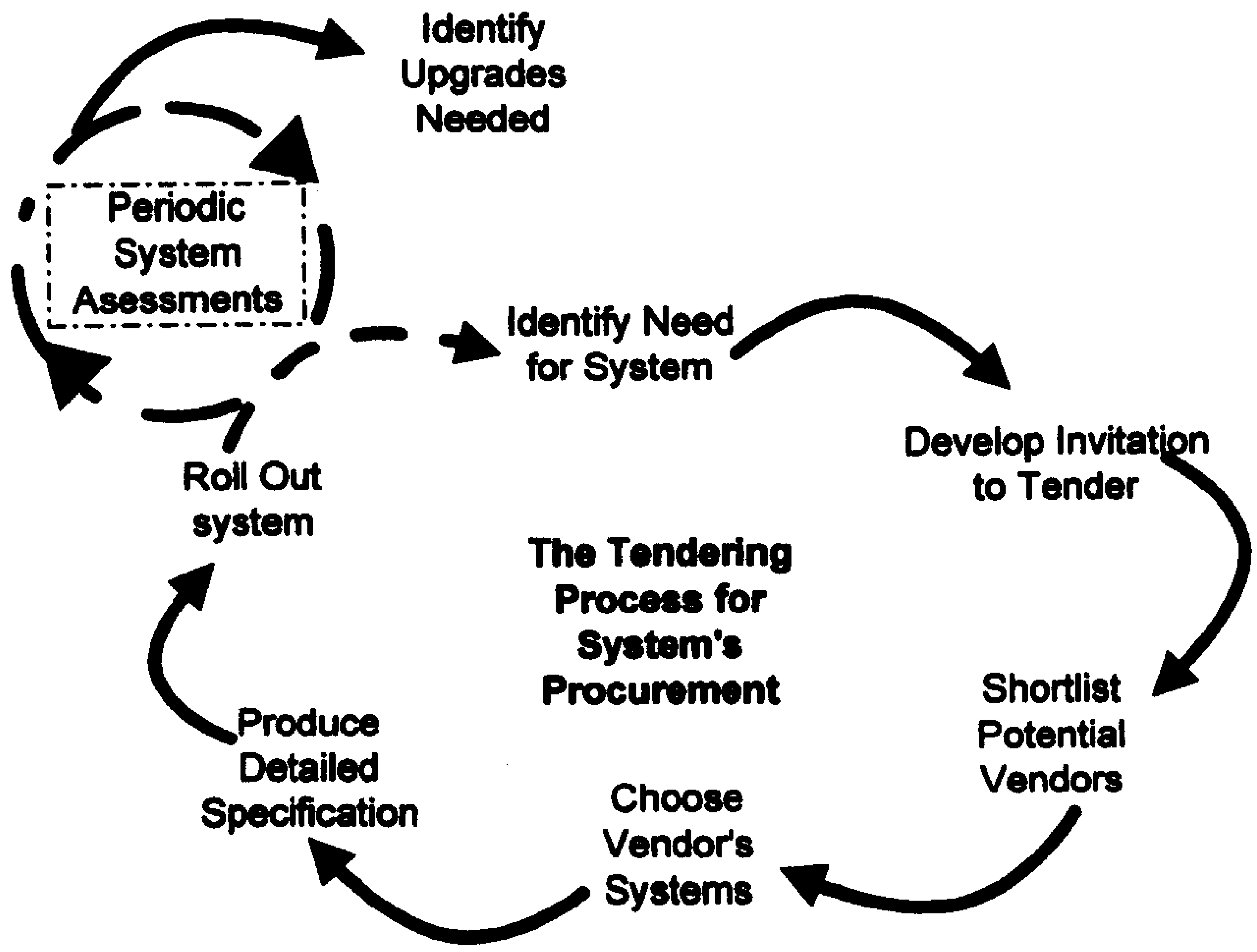


Figure 6-2: The Extended System Tendering Lifecycle

The only phase where there would **not** be an expected use of RAMESES is during system roll-out.

6.1.1 Using RAMESES to identify a business activity that needs system support.

- Undertake a feasibility study.
- Create an "invitation to tender".

6.1.2 Using RAMESES to evaluate a number of tenders to produce a short list of vendors

- Using the vendors' submitted features list.

6.1.3 Using RAMESES to choose a vendor's system: identify winning tender

6.1.4 Using RAMESES to produce a detailed specification.

- Draw up contract with vendor: Identify technical features, training requirements, support, upgrade policy etc.

6.1.5 Using RAMESES to undertake periodic system assessments: to evaluate how good the fit is between their expectation and the delivered system.

6.1.6 Using RAMESES to identify the need for upgrades and evolution of the system.

6.2 Buying off-the-shelf packages.

The process for buying commercial off-the-shelf (COTS) packages is initially similar to the tendering process. The main difference is that the package will not specifically tailored to the organisation. Most companies make extensive use of COTS packages – for instance Microsoft Office Suite, or a Sage accounts package. For the best fit of package to organisation most effort must be put into the specification stage: this is where RAMESES is of most benefit.

1. Identify a business activity that needs system support.
   - Undertake a feasibility study.
   - Create an "high level" specification.
2. Evaluate a number of COTS packages to produce a short list of packages
   - Using the COTS packages specification details.
3. Produce a detailed specification.
   - Identify technical features, training, support, upgrade policy requirements etc.
4. Evaluate in detail the short listed packages against the specification: Choose a system.
5. Roll-out the system: Have the system installed on-site, with planned training and support.

6.3 Developing systems within the organisation.

The process of having systems developed within the organisation, for anything other than small scale localised applications, is only viable where the expertise of an IS department is available. In this case the process used will depend upon the development paradigm adopted by the department: most commonly the "waterfall" or "spiral/evolutionary" lifecycles are used. Most control is provided where a evolutionary approach is developed. The focus in this approach, to minimise risks, is to ensure communication between developers and users is effective and frequent. The basic lifecycle components for this approach are:

1. Identify a business activity that needs system support.
   - Undertake a feasibility study.
   - Create an "high level" requirements specification.
2. Liaise with the development team in developing a detailed specification. Including technical features, training, support, upgrade policy requirements etc.
3. Feed into systems development process. Evaluate designs proposed ensure match to requirements is maintained.
4. Roll-out the system: Have the system installed on-site, with planned training and support.

7 Workpacks

WP/IC: Identify Change

In this workpack the manager proposing a systems change explicitly identifies this. The type of change proposed and the justification for it are documented.

Identify Change:
(state what the proposed change is, in terms of systems, or business activities)

Justify Need for Change:
Choose which of the following six statements most closely reflects your position

There is software system failure and we need to make a system change ☐
Our system is dictating our process and we wish to make it more flexible ☐
Our system is out of date and difficult to maintain ☐

We lack the information we need to properly understand our business position ☐
We know we are not operating at best efficiency and wish to investigate further ☐
We need to become more flexible to take advantage of new opportunities ☐

Other (please state) ☐

WP/ICC: Identify Change Consensus

In this workpack each senior manager identifies his/her agreement with the need for the change requirement identified by the initiator.

Then the level of consensus that exists among the individual senior managers, about the need for the specified change, can be measured. Where no consensus exists among staff it is unlikely that progressing further with the RAMESES tool will provide any useful information for decision-making.

The results from this workpack and WP/ICR are inputs into the filtering mechanism which determines the extent of data collection that needs to be undertaken in subsequent stages.

Identified Change Requirement and its Justification:
(from WP/ICR, specified by manager proposing change)

Choose the answer below that most closely reflects the level of agreement you about the proposed change requirement:

Strongly Agree	☐
Agree	☐
Don't know/ No view on the proposed change	☐
Disagree	☐
Strongly Disagree	☐

WP/CC Change Characteristics

This section is completed by senior managers to assess the level of experience available to support the intended system change

Time to complete the task should not exceed 10 minutes.

1(a). What time scale do you envisage for the completion of the intended system change? (Please tick the relevant box).

Within 1 week ☐
Within 1 month ☐
Within 6 months ☐
Longer than 1 year ☐

1(b). What is your experience of previous system changes within the time scale chosen above? (Please tick the relevant box).

All of our previous projects have been conducted at this rate of change ☐
We vary time scales according to the project objectives ☐
We vary time scales according to staff availability ☐
I have never undertaken a project on this timeframe before ☐

2(a). What is the scale of the proposed system change? (Please tick the relevant box).

Less than 25% of the total system ☐
26% to 50% of the total system ☐
51% to 75% of the total system ☐
76% to 100% of the total system ☐

2(b). What is your experience of previous system changes within the scale of change chosen above? (Please tick the relevant box).

I have experience of system changes across all ranges identified above (up to 100% impact) ☐
I have experience major implementations (up to 75% impact) ☐
I have experience of minor implementations (up to 50% impact) ☐
I have no experience of system changes ☐

3(a). What is the nature of the proposed system change? (Please tick the relevant box).

The change will be evolutionary the new system will be implemented gradually with a minimum of disruption ☐
The change will be rapid followed by gradual implementation with both systems running in tandem for a changeover period ☐
The change will be completed within a fixed period of time ☐
The change will be immediate with one system switched on and the old one switched off ☐

3(b). What is your experience of previous system changes of the nature chosen above? (Please tick the relevant box).

All of our previous projects have been conducted in this fashion	☐
Most of our projects are conducted in this manner	☐
We have undertaken this manner of project before	☐
We have never undertaken a project of this nature before	☐

4(a). What is the expected proportional cost of the proposed system change in terms of the annual systems budget? (Please tick the relevant box).

Less than 25% of the annual systems budget	☐
26% to 50% of the annual systems budget	☐
51% to 75% of the annual systems budget	☐
76% to 100% of the annual systems budget	☐

4(b). What is the expected benefit from the investment? (Please tick the relevant box).

76% to 100% business benefit as return on investment	☐
51 % to 75% business benefit as return on investment	☐
26% to 50% business benefit as return on investment	☐
Less than 25% business benefit as return on investment	☐

WP/DC1-1: Business Activity Model (BAM)

This workpack gathers data to construct a map of business activities and areas of responsibility within the organisation.

It is done in two stages, to define the areas of responsibility of the senior managers and then to define the activities and staff with responsibility within their areas.

WP/DC1-1a: Top Level Business Activity Model (BAM)

The senior managers who will be involved in the RAMESES process need to be identified by the RAMESES Initiator or MD/CEO.

All senior managers involved in the organisation need to be identified along with who they report to and their area(s) of responsibility.

N.B. A senior manager may have more than one area of responsibility and therefore may be entered several times in the table.

Senior Manager	Area of Responsibility	Reports To

WP/DC1-1b: Detailed Level Business Activity Model (BAM)

Each senior manager completes one of these workpacks for each of his/her areas of responsibility.

This identifies the business activities within the area, who has responsibility for each and who they report to. This allows the depth and breadth of the management hierarchy to be identified.

N.B. An individual may have responsibility for more than one activity and therefore may be entered several times in the table.

Senior Manager Name:	**Area of Responsibility:**

Activity	**Staff Member with responsibility:**	**Staff Member Reports To:**

WP/DC1-2: IT Usage within Business Activity Model (BAM)

The data collected in WP/DC1-1a and WP/DC1-1b is extended by having marked against it any IT that is used known to be used to support the business activity. This is done at both the top level and detailed level of the BAM.

This process reflects the managers' understanding of the software in use and its impact upon their work.

This enables the Extended BAM to be constructed.

Activity (Identified from WP/DC1-1a or b)	**Staff Member with responsibility:** (Identified from WP/DC1-1a or b)	**IT support**
E.g. Quotation for Customer	Samantha Scott	Quotations package

WP/DC1-3: IT Audit

This workpack gathers data from the IT system manager (or equivalent) in the organisation about the IT system in use within the organisation.

This workpack is broken down into four sections

DC1-3a – Hardware audit, identifies the hardware in use within the organisation

DC1-3b – Communications Hardware audit identifies the communications hardware in use within the organisation

DC1-3c – Software audit, identifies the software in use within the organisation,

DC1-3d – Communications software audit, identifies the communications software in use within the organisation

These audits are shown in the examples below:

WP/DC1-3a: IT Hardware

This workpack gathers data from the IT system manager (or equivalent) in the organisation about the hardware in use within the organisation. Please list all hardware within the system boundary. As shown in the example below:

Hardware	Usage	Operating System	Number	Age (or Age Range)
e.g.				
ICL 2900	Central computer	George III	1	10 years
PC 286	286 used as standalone PC's and also emulate dumb terminals to access mainframe.	MS-DOS5.1	5	5-7 years
PC Pentium	server	Windows NT	2	2 years

WP/DC1-3b: IT Communications Infrastructure

This workpack gathers data from the IT system manager (or equivalent) in the organisation about the commsware in use within the organisation.

Please indicate in the relevant box(es) the profile of the hardware used in the organisation.

Commsware	Description	Number	Installation Date
e.g.			
Modems	52.V	2	1998
ISDN line	2 pair	1	1997

WP/DC1-3c: IT Software

This workpack gathers data from the IT system manager (or equivalent) in the organisation about the software in use within the organisation.

Please indicate in the relevant box(es) the profile of all the software packages used in the organisation

Application Software	Usage	Version	Date Installed
e.g.			
Sage Sterling	Accounts	6.1	Oct 96
Fred's Estimator	Quotations	0	Aug 85

WP/DC1-3d: IT Communications Software

This workpack gathers data from the IT system manager (or equivalent) in the organisation about the communications software in use within the organisation.

Please indicate in the relevant box(es) the profile of all the communications software used in the organisation

Communications Software	Usage	Version	Date Installed
e.g.			
Lotus Notes	interdepartmental	4.0	Oct 96
Microsoft Outlook	e-mail	1	June 98

WP/DC1-4 Proposed Business Activity Model

This workpack gathers data from senior managers within the organisation about the proposed changes that are to be undertaken. In the first instance the detailed information about the requirements of the proposed change are identified in the following tables. The impact of those requirements is then imposed onto the enhanced business activity maps in order to ascertain the boundary for the second level of data collection. Repeat the process until all identified nominated representatives (usually senior managers) have completed the task.

Please rate each relevant requirement from 1 – 5, where 1 is desirable and 5 is critical to the business.

*If there are requirements **not** listed here please add them within the relevant functional area.*

Nominated Reps System Requirements	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:
Infrastructure								
Multi site system								
CAD/CAM interface								
ISDN/EDI links								
Windows 95/NT GUI								
Multi platforms								
Multiple languages								
Multiple currencies								
Desk top faxing								
Internal e-mail								
Internet links								
Fully networked								
Ability to extranet								
Video conferencing								
Access to historical data								
Real time information								
Security features at managerial level								

Nominated Reps System Requirements	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:
Warehouse management. Support for:								
Bar coding								
Kits shipping of items								
Product is shelf life sensitive								
Multiple locations per item								
Non stock inventory items								
Lot number traceability								
Serial number control								
Item traceability								
Stock inventory system								
Goods despatched								
Goods received								
Inspection per part								
Stores issue with auto reorder								
Inventory management								
Customer order processing. Support for:								
Produce quotations								
Quotation generator								
Quote history								
Enquiry tracking								
Archive customer remarks								
Flexible customer reporting								
Forecast sales/projects								
Sales								
Planning and Estimation. Support for:								
Forecast production demand								
Parts estimation								
BOM								
Operations and routings								
Purchasing system								
Parts/supplier history								
Simulation								
Subcontract								

Nominated Reps System Requirements	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:
Production. Support for:								
Made to order								
Make to stock								
Engineer to order								
Configure to order								
Material Resource Planning (MRP)								
Pull Scheduling(Kanban)								
Product based production planning								
Capacity requirements planning								
Master production scheduler								
Rough cut capacity planning								
Per machine/appliance recording								
Work in Progress								
Non-stock items								
Subassembly information								
Activity based costing								
Shop floor data capture								
Service requirements. Support for:								
Waste tracking								
Preventative maintenance								
Toxic/hazardous chemicals								
Environmental /emissions tracking								
Tooling information database								
Tool management								
Quality Management System. Support for:								
Process change/testing monitoring								

Nominated Reps System Requirements	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:	Name:/role:
Finance. Support for:								
Fixed asset monitoring								
Capital project planning								
Integrate with finance package								
Outstanding payments								
On-line requisition and manager authorisation								
Cheque printing								
Human Resources. Support for:								
Project management								
Project status								
Time and attendance								
Personnel/skills matrix								
Training matrix								
Allowance for shift system								
Health and safety recording								
Time and motion records								

WP/DC2-1: Business Component Task Analysis

WP/DC2-1. For each component identified in WP/DC1-4 a workpack should be completed.

Each staff member who has been identified as responsible for a named component need to:

1. *identify the business processes impacted by the proposed change*
2. *Breakdown the processes into primary tasks*
3. *list the key members active within these processes*

The time needed to complete this will depend upon organisational structure.

Business process	**Primary tasks**	**Manager responsible for process**
E.g. Manufacturing	Forecasting	Sue Smith
	Resource planning	Alan Jones
	Build plan	Alan Jones
	Production control	Alan Jones

Business process	**Primary tasks**	**Manager responsible for process**

WP/DC2-2: Business Component Task Analysis

WP/DC2-2. For each component identified in WP/DC1-4 a workpack should be completed. Each staff member who has been identified as responsible for a named component need to:

4. identify the business processes within his/her area

5. list the staff members active within these processes

6. identify who is at the start of each process

The time needed to complete this will depend upon organisational structure.

Business Process Component Name: Customer Order Placement

Named Staff with overall responsibility for the component: Bob Job

Example of completed task list

Task	Process Position	Employee's Name
Customer Enquiries	First	Sue Smith
Quotations		Alan Jones
Costing		Alan Jones
Customer service		Alan Jones

Task	**Process Position**	**Employee's Name**

WP/DC2-3: Business Process Task Trail

This section documents, at a detailed level, the actual work undertaken within the chosen business processes. Each individual user selected by the managers (or identified by their colleagues) should complete this task.

This output of this task will be a full description of all tasks undertaken within the processes under analysis.

Time to complete the task should not exceed 10 minutes per user.

Process Name:

Task No.: **Task name:**

Task Input:

Task description:

Task output:

Input description:

Input from:

Person

Role

Department

Input Received Is Generated: Automatically ☐ Electronically ☐ Manually ☐

Output sent to:

Person:

Role:

Department:

Output Is Produced: Automatically ☐ Electronically ☐ Manually ☐

WP/DC2-4: IT Skills Audit

This section aims to assess the level of the organisation's IT skill base. This can be an important factor in assessing the risk of change. For each piece of software identified please complete following workpack DC2-5. Enter the name of the software you use and the task you use it for. Then score the importance of the software in being able to complete the task. Where 1 is unimportant and 4 is essential .

(Time allowed 10 mins, per user)

User Name: **Age:**

Position: **Length of service :**

Formal IT Qualifications/Training:

Examining Body	Level	Grade	Subject

Software That You Use:

Software Title	Task Name	Importance

Skill Level *Choose the statement which most closely reflects your ability and experience:*

1. I'll never need a computer to do my job
2. I don't know anything about computers, they scare me because so much can go wrong. I will have to learn about them though
3. I use the screen to carry out my duties but if anything goes wrong I have to ask for help. I know which keys to press to get my work done.
4. I use the computer to make my work easier. I like to change things so that they reflect the way I do my work.
5. I am confident about using the system I have written special routines to aid my job.
6. I always end up sorting out other peoples problems, its not my main job but it seems to take up a lot of my time.
7. I am the system specialist and it is my main job to ensure that the system is available and reliable so that everyone else can do their work.

Please enter the number of the appropriate answer here: ☐

Training Assessment *Choose the statement which reflects your needs:*

1. I don't need to be able to use a computer to do my job
2. I would like to know a bit about computers, they are a mystery to me at present.
3. It would help me if I knew more about the packages I use to do my work
4. I know the packages I use quite well but I would like to be able to use them more effectively.
5. I can configure the packages I use and can readily adapt to new software. It would help me if I had advanced training so that I could develop new opportunities
6. I am familiar with most of our system and troubleshoot for the users. My training need would be to help my teaching skills so that the other staff are less reliant on me.
7. As the system administrator, I would like to take on further training so that I can keep abreast of new technologies and make sure that our system remains up to date.

Please enter the number of the appropriate answer here: ☐

Viewpoints *Choose the statement which most reflects your feelings about computers at work:*

1. Computers are more trouble than they're worth
2. Computers are a necessary evil
3. I can see what the computer does but I don't understand it really
4. Using computers makes work more efficient we couldn't do without them now
5. Business relies upon the accurate and timely information that the computers provide
6. Everybody needs to be able to use a computer these days.
7. Computing technology enables business to realise new opportunities.

Please enter the number of the appropriate answer here: ☐

WP/DC2-5: Task Trail IT Component

This section identifies any IT software which supports the work within the task.

Each user completing WP/BPTT is asked to also complete this task.

Time to complete the task should not exceed 5 minutes per user

Use of IT in task:
The task is supported by:
(please name the software component name or enter "None)

If task is supported by IT please answer the following questions, otherwise this section is complete:

The IT component is:
Part of an integrated system
An independent package
User-developed software
Other
If "other" please give some details here:

YOUR OPINIONS ABOUT THE USE OF THE SOFTWARE

1. **Does the software help you to be productive in your work?**

   It is essential.

   It helps a great deal

   It helps in **many** parts

   It is satisfactory

   It helps in **some** parts

   It does not help at all.

2. **In general, how would you describe the ease of use of the system?**

   Excellent

   Very Good

   Good

   Fair

   Poor in areas

   Poor

3. How would you describe the screens you use with this software? (are they simple to understand and work through etc?).

- Excellent ☐
- Very Good ☐
- Good ☐
- Fair ☐
- Poor in areas ☐
- Poor ☐

4. Does the system provide the accurate and precise information you need?

- Always ☐
- Almost Always ☐
- Often ☐
- Occasionally ☐
- Very Occasionally ☐
- Never ☐

5. To what extent are the outputs of the system actually used? (e.g. reports etc.)

- Always ☐
- Almost Always ☐
- Often ☐
- Occasionally ☐
- Very Occasionally ☐
- Never ☐

SUPPORT FOR THE SOFTWARE

6. How would you describe the levels of support for this software within your organisation?

- Excellent ☐
- Very Good ☐
- Good ☐
- Fair ☐
- Poor in areas ☐
- Poor ☐

7. How would you describe the quality of the support documentation?

- Excellent ☐
- Very Good ☐
- Good ☐

Fair

Poor in areas

Poor

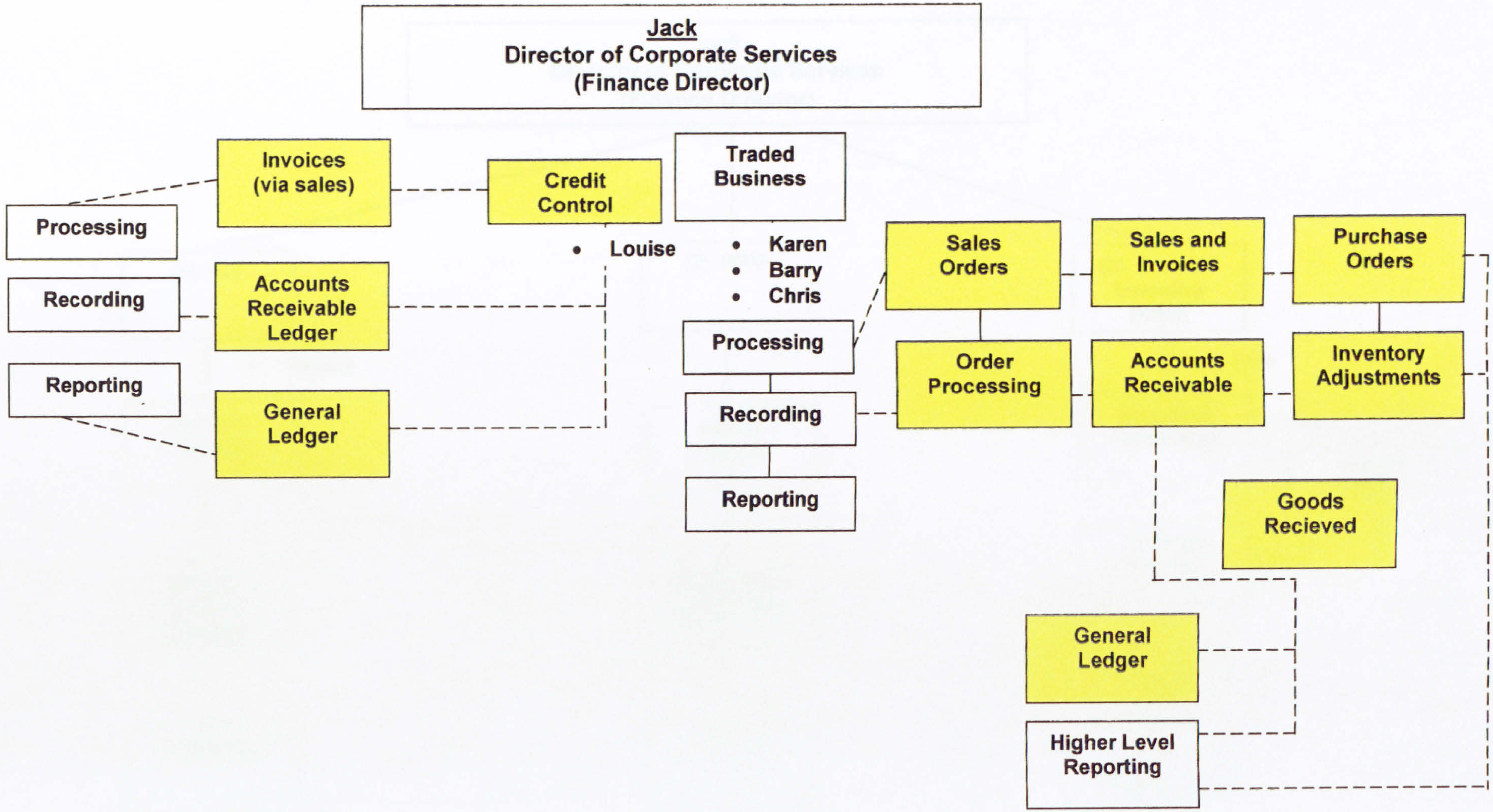
8 Glossary

Term	Explanation
BAM	Business Activity Model
Business Activity Model	
C&ID	Coverage and Intensity Diagram
CCC	Change Characteristics Chart
Coverage and Intensity Diagram	
EBAM	Extended Business Activity Model
Extended Business Activity Model	
ICT	Information and Communications Technology
IS	Information Systems (computer based)
IT	Information Technology
Map	
Model	
Nominated Representative	A member of the senior management team (or someone co-opted by them) with responsibility to co-ordinate and manage the data collection process within RAMESES.
ORION	
PBAM	Proposed Business Activity Model
Proposed Business Activity Model	
RAMESES	

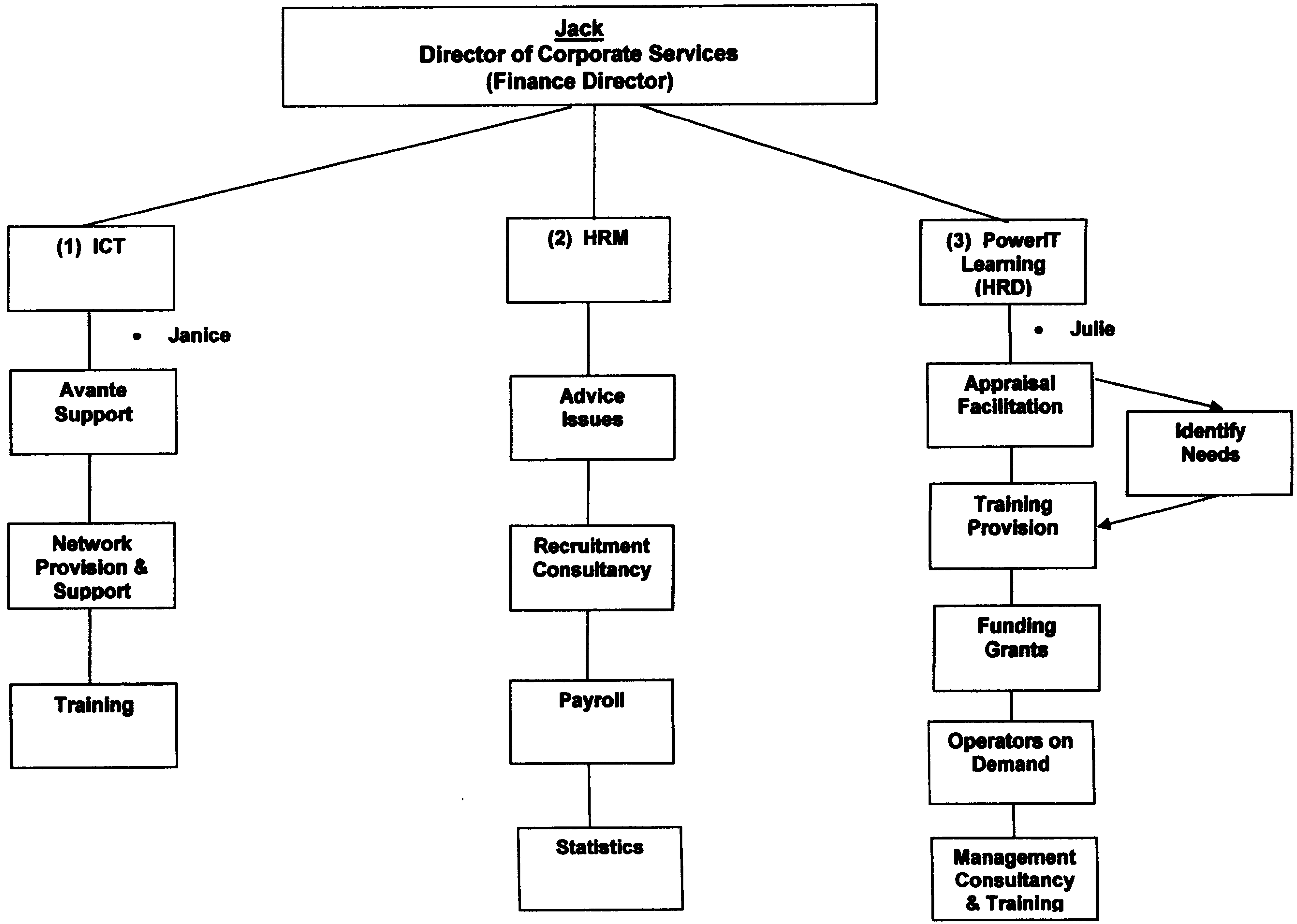
APPENDIX 2

Example BAM diagrams

Jack
Director of Corporate Services
(Finance Director)
FINANCE
(1) Traded
Amanda Price
(2) Value Added Business
Power
Service
Corporate Services
PowerIT Learning
To Page 2
Accounting Functions
Processing
Recording
Reporting
Len Gaul
Invoice In
Rachael
Payments Out
Louise
Accounts Payable
General Ledger
Assets & Liabilities
Petty Cash
Louise
Maintain fixed asset register
Maintain cash books
Bank Reconcilliations
INWARD Payable
OUTWARD Accounts Receivable
To Page 2
Kev
Where Avante is used
Where Excel/Word (MS Office) is used
Miscellaneous packages



Jack
Director of Corporate Services
(Finance Director)
Invoices (via sales)
Credit Control
Traded Business
Processing
Recording
Reporting
Accounts Receivable Ledger
General Ledger
• Louise
• Karen
• Barry
• Chris
Processing
Recording
Reporting
Sales Orders
Sales and Invoices
Purchase Orders
Order Processing
Accounts Receivable
Inventory Adjustments
Goods Recieved
General Ledger
Higher Level Reporting


Jack
Director of Corporate Services
(Finance Director)
(1) ICT
Janice
Avante Support
Network Provision & Support
Training
(2) HRM
Advice Issues
Recruitment Consultancy
Payroll
Statistics
(3) PowerIT Learning (HRD)
Julie
Appraisal Facilitation
Identify Needs
Training Provision
Funding Grants
Operators on Demand
Management Consultancy & Training

PRIMARY FUNCTIONS AND ACTORS

Additional Notes

Brian Smith (CEO)

A presentation is completed annually during December to the parent company. This would show the budget, profit and loss and aims and objectives for the following year.

In this meeting would be approval of the plan.

Figures are based upon the Progress:Plan figures released in the previous August. This is used to start the business plan for the following year. (ends November)

Jan - Mar:	Strategic Marketing Plan is considered
Apr - Jun:	Operational/Corporate Plan is considered
Jun - Onwards	Annual Planning


Sue
Operations Business Planner (Service)
Customer Pre-Alert
Issue RMA
Receive Goods
NC Issue RMA Receipt
Order Fulfilment
Book In
Acknowledge RMA Receipt
Pass
Fail
Test
Re-Work
Test
Q.A.
Note Company Pack
Document
Ship Product
Invoice to Custome
BER Scrap
Raise Work Orders
Works Order Receipt
Stock Transfer
Document
Ship
Repairs Fulfil
Accounts
QA
Pack
Reconcile
Compaq issue Picklist
Pick Components
Results to customer
Charge Taiwan
Issue Materials to work orders
Pay
Credit if Lite-On Liability
* Document
Repair Report
Customer Agreement
Despatch Note
Invoice
Ship
Raise Direct Sales Invoice
Account Manager
Maintain Current business
Winning New Business
Resource Planning
Compaq
Acknowledgement to customer
Labour
Receive Goods
Raise PO
PO Receipt
Disposition from Inspection
Run MRP
Raise PO
Place Orders
Goods In
Stock Warehouse
New Buy Purchasing
Receive Monthly Forecast (Order)
Raise Forecast Orders (4 Months)
Sales/Works orders for current week
Training
Assess Impact on Resources
Action
Staff Requirements
Facilities Equipment
Justify staff needed
Personnel
Staff reduction
Contact Agency
Assess
Action
Kev
Where Avante is used
Where Excel/Word (MS Office) is used
Miscellaneous packages

APPENDIX 3

Interview data

Employee who managed the system

History of system used now.

I believe it's a fairly old system. It's been around for quite some time for a number of years. We've had it approximately 2.5 years. It was introduced by the 2 directors. I'm not sure what their thoughts were before we got it. Obviously, we used to do everything manually. It was hand written which was very labour intensive.

You didn't have a computer system before then presumably?

Not for production control it was all hand written. carbon copied. and they were obviously looking around and they came up with the Redthorn production control system. It is capable of everything from the enquiry stage to accounts invoicing. We don't actually use it for the capacity, for estimating. We don't use the accounts package because the accounts package isn't suitable. Basically we use it for planning of work for the shop floor, for the first stage up to delivery note comes at this stage. It's a fairly rigid system. There is an opinion by certain people within the organisation that it's not very user friendly, which is true for a certain degree. The further you get down the chain from the planning stage, the further you go into it, the less user friendly it gets. Once you get to the advice note stage, it tends to be fairly fixed and rigid. It doesn't let you move things around as much as you'd like to. That's about it for the general view of it.

If you like I can tell you a bit about it. As I say, there are 10 options. The first one is the sales option obviously. It actually starts at entering an order. Do you want me to go into really specific detail? It's not really my forte this bit, but I think I know what I'm talking about. Every component that we make has an internal reference number, basically its own personal identification number. There are two different types of internal reference numbers. There's what we call a 9 digit reference number. or used for components supposedly built to a high . What we call a 6 digit reference number is what you'd to the customer against. So in theory you've got certain levels of 9 digits, get manufactured and built up, into a 6 digit which will go out. That's the theory. In real practise, we must be slightly different to a lot of other companies who have got this, because we deliver a lot of to customer against the 9 digit reference which it's not really designed for. You can, it does allow you as I say it's something that causes problems when you stage. And we take the user more than we do the proper way shall we say. So, if you get an order in for instance, basically, what you have to do, say it's made up of 5 components. For each of the 5 components, you have to give each component a 9 digit reference. Just basically this screen here. As you can see, I'm giving it an identification number. Obviously description, drawing number, issue number, whatever. You give all the components an identification and what you have to do, you have tell the computer what material they use which is in the planning stage, continue planning, you put in the identity. It'll flash up the customer part number So you know what you're talking about. Then what you do in the next box here, every item of raw material or fastening or whatever has unique identification as well. Again, that's made up of a 9 digit reference. Sorry, up to 9 digits maximum, and basically we have a coding system for that which is documented in the procedures which I can show you later. So, basically, you put in the relevant material. The estimators would plan this by the way, put in the relevant material to complete a job against it's identity . Then what you have to do, you have to the labour. Again, you select the labour planning, again put the identity in. All of our machine resources have an identity number, a three digit identity number, and again you just plan the labour planning as the manufacturing.

Does the computer actually do the scheduling itself?

Yes.

Can you get it to auto schedule?

Yes, the capacity scheduling function.

Do you use that presumably do you?

Not at the moment. All we've had is approximately 2.5 years. We've tried it once or twice earlier this year, but we've had a lot of problems with it.

It's still done manually then. You still schedule people's workload and stuff manually then?

To be quite honest, it's not something that's done as such. It's basically down to the guy who runs the shop floor and we have like a weekly production meeting. Basically, it's all done verbally. You know by delivery date and which customer's been on the phone. It's a very useful function on the computer. Capacity scheduling, as I say, you put in anything you want. You tell exactly what you want from dates. What tends to happen is control of the job card by the shop floor is very very poor. Obviously, to achieve the level of capacity schedule, they've got to be really controlled. What you find is, some instances like you've had these job cards last year. As soon as they've finished, they should come in to get finished off. We've actually been getting cards this months that are like a year old. It's really that poor. That is the worst case. That gives you an idea about how badly it's controlled. So, until we get the control, it's basically not worth the paper it's written on. It's actually part of it there. It's not the format we use. We've actually done it last week and tidied the system up at the moment, getting all the rubbish off. That's actually the capacity scheduling runs, go the different resource centres, what we call the job number, component when you enter it as a new order, in a separate job card number what we call it. A description. And basically, you run the capacity scheduling. There's an example there. We have this job here 26th May and it hasn't had any time booked against it yet. So, you would assume it's finished, but it's still out there somewhere. That gives you an idea how poor it is. And if you want any of these, you can take away if they help at all. That's actually the format we'd use. If you go further in, you can see the situation more realistic. Right here, you're starting to talk about realistic dates.

That's the actual start date?

That's the recommended start date recorded the lead time for the labour and the material.

But you don't actually use this at the moment?

As I say, what we are trying to do, the system is such a mess. several weeks ago some of us just down and we discussed which way we wanted to go to try and look for something more suitable. Because I think we are split 50:50 certainly Some like myself want to stick with it. We've had a two year

Why do you think it's got into a mess then?

Several reasons really. One as I say is that the control of the job cards is really important. Now, everyone's realised just how important that is. Certainly the mentality on the shop floor is no fault of their own, but obviously the guys on the shop floor are just concerned with getting the job done. I think also it's possibly training from the company where we purchased the software from. Even now there's things where you're working away on the computer something will appear that was there and you didn't realise that it could do that. I mean we had examples of that this year. We're actually 2.5 years down the line. There's still things you don't know it can do. So, certainly lack of training comes into it in a big way. All our initial training approximately - it was a few hours each in small groups. Myself, I had the most training of anyone. I supposedly control the system to the best of my capabilities which isn't easy sometimes. By far I've had the most training which in total probably extends to about a week and a half., possibly two stretched out. But basically, a lot of the things I've picked up, I've picked up by just using it. On the system itself, there's two systems, there's the real system; there's also what you'd call a play system which, as it suggests, if you want to play with it. If you're curious to know what something does, it won't effect what we store on the hard drive, server rather.

So it's on the work then presumably.

Yes, Yes.

Is it a PC software

Yes.

So it's networked around the company?

The network itself has caused problems. We're licensed for a 7 user system, and as soon as you've got 4 people on the system, it won't let any more in. Really, it's silly things like that. You know, minor problems. There's most.

You mention that there's two schools. There's people who decide that you should keep it; there's others who want to get rid of it. So there's various arguments in each.

It goes from different departments. Purchasing department for instance up until recently were dead against it. Because as I say we're using these purchase orders were using a separate material code, whatever that code is, say, on a job card request, and the order is something slightly different. You have to manipulate the system to put the two together .It's not very flexible, but it's a bit of a drawn out process. It's so much quicker to do it manually and not actually use the purchase order system on the computer. They've got a separate purchase order system on an old database program on a single stand alone PC. That's one of the arguments, the purchase department.. As I say, Accounts do not use it at all. We found out recently Peter Rennie one of the directors visited the company we bought the system from about a few long standing complaints. He was actually told by one of their representatives they actually admitted that the accounts was actually rubbish They didn't even use it. It's their software, they use a separate sage system or something. This is like 2.5 years down the line. They're admitting that to us. Another major problem we're having is we pay for support by this company, and we basically don't get it at all. I've not actually been their myself, but I presume it's not a very big place, personnel working there and the problem you get if you have a problem, you ring up to speak to one of the programmers, and they won't speak to you. I've told they're not allowed to take direct calls, so you have to relay messages and what not.

It is a manufacturing control system you've got?

Yes.

Is it an integrated package for all the place.

Yes. Basically, as I say, my argument is. Sorry we don't use the inspection function either.

So what do you use of those activities, if you don't use them on the computer system?

Accounts use a totally separate system. They use PEGASUS at the minute. I think that system itself is about 10 years old. I know they're looking to replace that. Inspection just use the manual system, hand-written. Purchase use this system to about 80-90% of its capability. As I say, we also have a separate purchase order system if this isn't flexible enough, they'll which causes a problem in itself, because you are wanting to be moving away from this. So they tend not to, because they have raised a purchase order somewhere else, they tend not to tell this system when you come to do the. You haven't got the material, but it's there, which causes a problem in itself. That's how much we're involved in it really. Most of them do, they're a bit iffy about it. But from my 50% of the argument's side, the way I see it is if you get a new system, what's to say you're not going to have these problems. Basically, you've lost 2.5 to 3 years straightaway. So, we have progressed quite a way with this in the last few months. Basically we've sat down. That's one side of the argument.

Getting back to the system, once you've done your material planning, we then go into the sales function, and basically enter a new order. There's a lot of functions on here we don't actually use. Print estimate we don't use.

Why's that?

Well, all estimates are still done manually.

Why's that?

It's just the way the guys tend to like to work. They've never actually gone into it. Another work is, they repeat the work anyway. It's over and over again. A lot of estimates we do tend not to get. Obviously, we do a lot of estimates, but we tend to get only a certain percentage. It's just that he works the old school. They have done it from time to time to play with it. When they're quite. It's just very long and drawn out. It's a lot easier, it's a lot quicker to do it manually some time.

How does that impinge. You mentioned something earlier about purchasing causing problems if they used a different system. How does that effect this system then with people doing these tasks manually?

Not at all really. The way I see it is that it's like a length of chain. Each function is linked. The accounts doesn't really effect it because it's the end of the line, and estimate doesn't effect it because it's the beginning. It's when you start doing bits in the middle that you tend to cause problems. As long as it's a flow. You could chop it down as much as you like. You take off these at the end, it's all. So estimating doesn't come into it at all whatsoever. Accounts, slightly, because obviously invoices from advice notes clear the system off. We do keep them, but they're not worth the paper they're written on. Basically, what we still do for invoicing purposes, all advice notes are raised on this and basically a copy of that advice note is manually priced up, contracts manager in the accounts department who weigh them. So the invoice on this, they're just printed off. So you get a job in anyway. When you get a new order, basically what you put in is the identity, obviously how may you want, when you want them, order number. This thing material trace. What we actually use in there goes back to our old manual system whenever we received an order, obviously, this is the old hand-written order, the 4 digit number. We still use it just to. That comes into accounts later on, so it's just, put the number in there. Basically, for accounts purposes, we use that 4-digit number. It doesn't matter for an item. They need to pull all together . Because we only tie the order to that one, 4-digit number which they do. Every card we've got, every job we do has always got this identity here. The computer will give it an identity. We've got this separate, old manual identity. It's basically got 2 identities.

Is this system specifically set up for you then by the people?

No, it's just an off-the-shelf package. I don't even think it's been tweaked at all. It's basically an off-the-shelf package. You enter the order, then what you would do, is print the job card. This is a job card. That's the identity there. There's the 6 digit number. So the material trace number. You have your material requirements. That's specific to that piece of bar. That's not a very good example of labour planning. We produce this assembly. We produce the top level copy that you've entered it against. After it's produced that, you search the computer for stock levels, to see the sub-levels to make that job. If it did have certain ones, you have to take them into account. Then it would split out the rest of the card with the figures adjusted to take into account stock and whatever. So then you've got basically the number of cards for a job. What you then have to do, take into account if it did do that. Say your top half is ten and you have the cards and the numbers are 6, 5. What we have to do is what we call launch the top level job card. Basically what we do at the top level is we would list in the material planning, all the components to make that job, and what you would do is, launch it, which is on. Basically what you are doing there, you put your job number in. The top level job. And you just enter through it, and it produces a report to the printer. Basically, what it does, all that are in stock you don't have to make. It basically pulls them out of stock, and puts them to that job so no one else can touch them. Every component you make component of raw material that comes into the door when it's booked in, it's given what we call a GIN number. It is an identification number. It's basically that number there. So, if the guys on the shop floor have to make the assembly, in theory go to these are held and pick the GIN number. You know how you identify by drawing number or whatever, they're supposedly identified by the GIN number which we are just starting to get into now. We are supposed to have been doing this for 2.5 years. We have just got into this over the last month.

Why was this?

It was the just the mentality really. The mentality of certain people on the shop floor. Say in the last couple of months, we've only realised certain things.

What was mentality was it. Was it two computer systems doing this or what.

Basically, we didn't identify things with the GIN number. Raw materials, the stock control side works pretty well. The guy's pretty good with it. He gets a piece of bar in, he has to come and book it in. Gives it its identity number which we had to stick with for the requirement of the standard that we had for traceability. Internally, if there did happen to be any. Right we've tried to not make things for stock. We don't like to have much stock which the components if we can help it. Basically, if there was anything there, there would be a guy off the shop floor of there would be a drawing. Oh, that looks all right, we'll have some of them regardless of what number it's got. We do loose the traceability a bit there if we can get away with that. So, that's about it for the production of the job card . The guy would then in theory go away and manufacture the job, depending on how long it takes, every body will fill in a daily ticket. This is what effects the capacity scheduling. So, basically the daily ticket. What we would put down is that job number and we put the operation number down. Then, you'll put how long it's taken on the job, computing operation or not. That's the information that tells the capacity scheduling whether it's done or not. Again, while that's not effective, because of the mentality of the shop floor. All they want is doing the job and getting paid at the end of the week. So, basically, that isn't worth the paper it's printed on. But there on that first example I showed you because I've tidied it up. Basically, what I had to do is go through the printouts, tidy them up to reflect actually now as opposed to 6 months ago.

So they're not interested in feeding you back information once the job's been finished?

As I say, even now you try and hit home the importance of it. It doesn't seem important to them. We've got to the stage now where the thoughts are now because they've been told over and over again. Some of the silly things, you get these daily tickets. I think the worst example was one guy actually drew a sketch of what he'd done, which means nothing to anybody but him. So the train of thought is now. What they're thinking of doing is getting paid on a clock card on the ticket. Actually contemplating the 2 directors paying them off their ticket as well because obviously there are days when some guys don't hand them in. That's persistent offender there. So you actually contemplate how this effects the system. The train of thought now is to think that if they don't hand their ticket in, or if they had their ticket in factory and after problems, they basically won't get paid that day. Looking after which you think would jolt them into some sort of action. It's the only sort of thing they'll understand which is a bit of a harsh thing to say but it's the only way of getting round it now, we're so far down the road with it. So, obviously once the job's in progress and the guys are booking time against it every day supposedly what you then have to do is that once the components are finished obviously you presume you must finish the components before you start building at a higher level, they actually have to get entered into stock. So that's basically the advice function. You'd enter what you'd call the advice portfolio and the advice notes. They are basically entered into stock. The function up here it says deliver into stock. You enter the components into stock, then you get your top level again, and again what you did earlier what you call launching the card. Obviously there's more stock there now. Hopefully, the computing requirement for that. You book it to that job and they can work on that assuming that everything's OK and its worked to, time whatever. Job's finished, obviously goes to inspection. It's inspected. Now one of the inspectors would come in and see one of the administration clerks, go to that same function again, enter the advice note, obviously this time delivery into stock will be low, and you can put in the details, order number, quantity advice note. Simple in theory, but there's not much work. So you do that. Obviously print it. You can print it, say if you want, a certificate of conformity if you want. Then it goes out the door. Then the completed job card should come in and they get checked to make sure that all the materials have been allocated and what not. They have another print out of that. They're off. Basically, say that job was actually manufactured; those pins were made. If you haven't put that material to the job on the computer, it will stay there forever. That paper hasn't been done. So just because you enter this as complete, advice note, it doesn't automatically take it off; it stays there forever, and burrs the system up. That was one of our problems.

Is that a system fault, or is that just your process fault?

You see our process wasn't. Raw materials was fine, the stock control guy is pretty good. The problem you got was the components. They are manufacturing all these components. They're getting booked into stock, then this lotion function wasn't getting done, so they literally had thousands and thousands of pounds in theory in stock when there was nothing there. And the knock on effect of that was a lot of our work is repeat work. Next time you come to do the same job, they enter the order again at the top level. The computer would check the computer stocks, thinking that you've got them all there, and in theory you haven't. In fact, and it wouldn't print out the top level cards. So, basically, you give this card out, and you say how do I make it? Well, there all there, but they're not. Then you have to come back and you have to start entering the cards separately. That was what used to happen until recently. Basically, what I've done is in the last couple of weeks, we've done a stock check on finished components and that's accurate. Basically, as it stands at the moment, there about 2 or 3 days old. These are all the components that a lot have just been booked against the stock check. Basically, what it tells you on here is it's got its identity number, its got a quantity description, its got its GIN number, what's been booked against the identity number. These are probably now about 80% accurate. So, what we do now in recent days, if we print a job card off and it doesn't print out, what we used to do, bearing in mind that we don't manufacture anything for stock as such, In the past, if it printed out and it was funny quantities, they were 10, we'd go in and amend them, or enter the cards separately. Produce that to indicate we haven't got the stock. What we do now, it's only in the last 2 or 3 weeks, is it does fit out from the quantities. We've got to accept that it is right if you go down the nine fire it's not, and we're doing something about it. That's the way we're working now. On exception, it's going pretty well. What I still have to do with,. We have these meetings approximately once per month, we come out with any problems we've got. The outcome of the last meeting was the system up. I'm actually in the process of writing some procedures. Everyone's got the standard manual they got initially. What I'm actually in the process of doing is doing procedures for specific tasks. Hopefully, once I get them done to distribute. We have to write them what I call with quotes. It should that there's not much left to go wrong in theory. A lot of people are being instructed verbally and are working that way now on certain things. We're in the process of getting those notes out now. Basically, so we add an advice note here., print the advice note out, so it produces the invoice. So if the actual job itself, go into purchasing function. What happens there is its supposed to happen every day. I'm supposed to generate a print out every day of all the material requirements to satisfy these jobs, but for one reason or another this printout is supposed to take a maximum of 25 minutes, and due to the poor standard of hardware we've got. The network server is a bit slow as well. It takes anywhere from 3.5 to 7 hours. A guy can't produce a report for 7 hours. It got down to doing it once a week and we're still at that stage now. We got round it not through a plan but by accident. Everyone of these cards that's produced is photocopied, the reason being accounts don't use costings. They don't use the system at all. Basically, just photocopy that job card and passed to purchasing, and he a lot of the time would say that it was due a few days later. And they check it against its stock, and tell the stock controller just to confirm it. If he didn't have any, he would jump in and buy it. He couldn't get through his list. We were covered that way, and it's worked out quite well. The reason this is photocopied is that these are priced up manually, and passed to accounts for material costings for specific jobs. So as it stands at the moment, this list is printed once a week on a Saturday when everyone's off the system to try and see if it helps a little bit. For one reason or another, the last couple of weeks with the system getting tidied up, I think last Saturday's report was down to 50 minutes which is almost acceptable. So basically, he does his list. For long lead items, he works his way through his list. He basically summaries if he sees the same item on 3 or 4 different cards. It tells him the total quantity. It still spits out his job number, and takes account of the stock he may or may not have balance to order, or if there's ordered stock, there's just more to pay. So he would work his way through that, and he basically enters a purchase order with suppliers we have, every supplier we have has a supplier number and every customer has a different number. He would enter the supplier number, and he enters the material reference, and how much you have ordered. This price here automatically appeared from what we call the material database which is input by the estimating department. Obviously you have got to code the materials for the job. They all use the same database obviously. Then purchasing will put in the development price.

Do you put materials here for different jobs? Stores of all the materials you might use on your various jobs, or is it a specific one?

No, its for all. We can use this code for anything. Purchasing use this code to order against, estimating use this for planning against. It's always the same unique code, and it would just order that way. There's a stock balance there, and a price in there. It does show that information, plus any outstanding purchase orders. So, he would basically enter his purchase order, print it off and fax it out.

Once that comes back whatever's delivered into us it goes to the stock controller. What he would do basically is a goods received note. So he's got his purchase order number. Basically, he would enter line number, line 1, quantity received, customer/supplier/advice note number whatever. Then this GIN number automatically appears. That's the bit that goes on a piece of raw material. It's now got its identity. Then when he launched it, he notes the material to the job, he hand writes down there. You don't have to. It's just something that's been inherited from the old manual system. It's a safety net; it doesn't take up any time. Once the materials are put in the job, manufacturers are described, job's finished, it's advised out, The other function we use on there.

Labour, that's the work force?

Yes. It's basically the input of the daily tickets. Again, we don't actually use this computer system for labour costings; it's actually entered twice. Once into this system to basically keep it clear. You can't get round; you have to it. We keep this print-out there. It's also used to input into the actual system which they use which I think is. I think that have a good system on which they take the costings for labour.

Why do they do it twice then?

Well, it's basically because this does not give the accounts department everything which they need.

So, it's accounts who do it then?

Yes. Sorry, it doesn't give them everything they want. They put this input here to satisfy the system and to keep it running smoothly. Again, just daily labour. We put the employee's identity number in, job number, wage number, start, finish, yes or no, That's input every day. Again, it's purely to keep the system clear. I think that's about it really, that's a general overview of the system. That's basically what we use day to day. I don't what to complicate matters. There are other things we can use, job costing report, this gentleman here prints it out, It's not used, it's not a vital document, because costings are monitored by the accounts department.

So, how is information transferred from here to the accounts system?

As I say, everything we use is input twice, accounts, labour is input twice, The material costings are gathered from this. This is a bit of a labour intensive job. Everyone of these they want as a photocopy. Probably that many say. The purchasing clerk has to go through a price them up individually, total them up, it's input manually onto a speadsheet, printed out then passed through. It's a bit labour intensive, but until they get something some thing more satisfactory.

It's printed out from here then, and re-input in accounts?

Yes, basically.

Is that the only instance here where that's done, or are there other examples of that sort of thing?

The only other example of inputting the same information twice. Is probably in purchasing where there is that purchase order system with that computer where it doesn't always happen. By right, they should input on here as well to satisfy the requirement, otherwise the computer will not assume anything whatsoever because it won't assume that the labour's been put against it, it won't assume that the material's actually been used. You have to tell it every step you have to tell it. It has causes problems for use in the past because we haven't been getting that routine, that discipline.

How much of problem do you think that is, having to re-input stuff? It's actually done twice then? You could in theory use this package and it would still do the job?

It would do the job, but accounts do not like it at all. You have to ask them why. I don't know myself. They refuse to use it; they've never used it. I don't think it gives out the information they want. What the Redthorn company that supplied the system actually said recently was they don't use this account.

What they actually use, is they use a SAGE system in conjunction with this, which is actually the package that accounts are currently looking at to replace this PEGASUS. I think this PEGASUS is going to have the problem of the year 2000 or whatever. I'm sure it's about 10 - 12 years old.

How much of a problem is the re-inputting?

It's not too much of a problem We've got plenty of labour available in the administration department. So, it's not much of a problem; it's just labour intensive.

How do you ensure that the data is correct on both systems?

Well for Redthorn, it's

No that it's the same data, if you've got it stored in 2 separate places?

I don't think it's really critical, because what's input on here is purely to satisfy the system; it's not used for anything apart from this. It should be checked for this, but it's not. The only way it's checked is by myself. I go through it once every 3 or 4 months, and say it has to be finished and check, and I basically go through line by line. For their side of the system, the accounts side, Our system actually uses, I believe it's checked. Everything has to tie in obviously with the. The labour incidentally has to tie in with the clock. There side's checked which is fine. Our side obviously isn't checked so much, not on a regular basis say. With a lot of the reports that are printed out by us, it's a case of myself when ever time permits really. We get a print-out, go through and checks. This is what we call a live job print. And according to the computer, all these jobs are still live. If you look at the first one for instance, job number there, I can see it's quite an old number, the day we required the job was actually the 21st February 1997, so there's a good chance it's finished. This has actually been tidied up. A few of the earlier ones have to be checked. That was actually probably about 3 times that size before it started, purely because cards haven't come in, the labour hasn't been booked off, it gets down to control. Everything's down to control of the job card. So, that's actually been tidied up. That's not a bad print out now.

Apart from this system, what other computer systems are there used around the company?

Purchasing have an old database. It's a stand-alone PC.

That pre-dates this thing?

That's the old purchase order system from before the introduction of Redthorn. Again, it was just an off-the-shelf database that we just adapted to suit ourselves. Apart from that, Accounts have a Pegasus package which I'm not very familiar with, and as well as obviously the Redthorn system,. Each PC had personal stuff spreadsheets or whatever. What sort of things would people do on their private stuff then? Just spreadsheets for control of certain contracts and what not. Just to assist the smooth flow.

How would that be done on the main system?

It is possible. We did experiment with it about 2 years ago. We had all our files on there with Microsoft Excel and what not. It's something we'd like to do which has never taken off. It's something we'd really like to do, because what happens now is these spreadsheets are produced on, this guy is doing one now, what he'll do is he'll print it out, and the hard copied is handed in a file. Anyone will just come along and have a look in his file. In the future, so we looked at it once before, but it never took off.

How much of a problem is that, with this information stored on people's spreadsheets rather than this central system?

It's not a problem at all. It would just be a nice step forward shall we say. It would be useful, so as some guy doesn't have to come through and look at a file.

Would any sort of system, would they have pre-dated this integrated package?

Well some of the windows is 3.1. We're not very consistent. Some have 3.1, some have '95. It's just a case of. When we've purchases hardware in the past, it's not a case of buying PCs for everyone, this level. Everyone's at a different level. The standard PC. Probably these 2 here are 2 of the oldest. They're 486s, but they're probably about 3 years old. So, there's varying degrees which causes a problem as well. There's a couple of what we call dumb terminals we have which are used to access the network, the Redthorn network. Can't think of any other packages really. Don't think there's anymore.

So basically, there's you have this central system and you also have these few isolated mini-systems like that one over there.

Yes

Around the company for personal use.

Yes.

That would actually still be company stuff done on there?

Oh yes.

But it's just separate from?

Yes, as I say, it's personal use to use whatever spreadsheets for whatever purpose.

And that's stuff that couldn't really be done on the central stuff then?

Yes, it could be. I mean if there was any sensitive material on there, you would just try to protect it or whatever. That's just about it. The only thing that I wouldn't put on is probably the Accounts because the Director just doesn't like that sort of thing. It's probably the one thing we wouldn't put on. They've got a separate network anyway for accounts, between the accountant and the financial director, and their clerk. So really wouldn't come into that anyway. But anything else. I mean I do things I do my own reports on internal quality audits. This system and my computer alone. There's nothing to stop anybody else accessing them if they wanted to. That's why it's set up that way; it wouldn't cause a problem. As long as you've got a read only file.

But on the separate systems, there's no re-entry of data; it's just, you just use that system for that particular task and you don't, there's no, like with accounts where you have to enter the data twice on the stand-alone spreadsheets. That's just used on his thing. You haven't got a problem with like transferring data.

No. It doesn't appear anywhere else.]

Just on his thing?

Yes. You see the copy is the hard copy. Nobody else has taken a copy on a disk or anything like that. Certainly not to his knowledge anyway.

1.1 Peter Rennie

When we took the company over we, its was operating on a manual system and we looked at, or we had a need to produce documentation far more quicker, far more efficiently than what we were doing. So, we had consultants in. We looked at various different methods, rather than going straight to the computer, none of which were satisfactory. We tried little bar charts and things like that, but they didn't work. So, we had been looking at a production control system for quite a few years, and it took us 6 years to decide on this particular one before we actually went ahead and got it.

Did you have any computer systems to support your work before that time?

No. Nothing at all. Everything was purely manual.

No spreadsheets?

No spreadsheets , nothing. No computer support at all. So we knew we were taking a great risk going from a manual system straight into a production control system. I'd looked at the system over 6 years on a lot of occasions and I was quite happy that was the way to go. And we decided because the way we were that we were going to get the system and purely on the basis of producing job cards, and being able to automate the production of job cards, and then eventually trying to develop it into a production control system. We weren't sure whether the purchasing side of it was going to function adequately or not, but we thought well if we can get automated production of job cards that was enough. So, anyway, we went ahead and got the system and we've had problems as I've discussed with you earlier because basically the training in my opinion was inadequate. We weren't told about key functions of, the key functions weren't impressed on us how important.

That's by the supplier?

By the supplier, yes. And here we are with the system which basically encompasses purchasing. From my point of view, I like the system. I don't think there's anything wrong with the production control system at all. I think it's basic, it's logical, it fulfils our needs. As far as I'm concerned the fault is with us. We haven't adjusted to using the computer system, we still think that we can get something out of it without putting anything into it, and I strongly believe that over the next 12 months we'll develop our skills a bit better and work the system better than what it is. Whether there's now a windows based system that's going to be better than this or not, I don't know, but at this stage, I still think we, because of our inexperience, our inability to use it properly, I still think we need to give it a little bit more time to work properly for us. And that's where I see we are now.

So, you are not interested. Because one thing that was mentioned before was that you wanted to go and buy a new package. That's not the case now?

Well, it's certainly the opinion of the likes of Paul who's not happy at all with the system, but, as I say, I think that's based on the understanding that the system's not working right. But, as I say, the system's not working right, because we're not feeding it the right information. We're not running it properly. Now I think that's one of the things that you uncover in your research over the next month or so. That basically there's certain things that we're not doing quite right. Whether there's a system that's easier to operate or not, I don't know, and I think that's worthy of looking at. But I think that they're some very complex interfaces that we have at the moment.

How much of those is there people using their own separate system still, in Accounts for example?

Yes, the Accounts. Again, there's a strong case over whether the accounts should stay separate or not. I don't know. But certainly the Accounts department do not want to be part of the Redthorn system. And I don't blame them. The accounts side of the Redthorn system is appalling, very, very basic, and it doesn't give us the management information that we get at the moment. So, that's not very good. But the problem as I see it is that now we have a system where we're collecting data off the shop floor and there's lots of effort been spent feeding that information onto both systems. You know, and again that's an area where we've seen lots of errors, and may be we have to decide at some point whether we're going to continue putting that information into Redthorn, although I don't know. I think that needs further investigation as to what we're going to do with that.

1.2 Accounts

I understand, because I have been talking to Gavin about his system. But I understand that you use a different one.

Yes, we're completely stand-alone from Redthorn. We have nothing to do with it. We don't intend to have anything to do with it, unless there's major improvements in the system. The Redthorn system itself we're having a few problems with at the minute. I assume Gavin's explained that we're going through trying to get the system to work for the production side. The accounts side of the program is abysmal. There's very little, if in fact nothing that we would get from a working Redthorn system regardless anyway. So we use, well we're currently using 2 re 4 separate stand-alone systems for accounts preparation.

What package do you use.

Right, well. I'll you what, I might explain a bit better if I do you a drawing. Right, the actual accounts preparation if you imagine we have a central core, and we're using PEGASUS at the minute. Now this is what I used to produce a monthly management account. Now the information for Pegasus I prepare journal vouchers to put it in. Now the purchase side of our accounts is covered by PEGASUS as well. Well also in the PEGASUS we have my Excel spreadsheets. Now what I use that for is to basically control of debtors, and we have a system of part sales where, it's like long term contracts where, and to monitor the long term contracts because of the way we allocate sales invoices, I have other spreadsheets that I use in Excel. The information from that then allows me to prepare journal vouchers which go into PEGASUS.

So, what you do on Excel, is something that you can't actually do in PEGASUS?

Not really. No, the way it works is a sales invoice will go out and it'll be on one contract, and that contract will maybe run for 2 years and we'll have a number of sales invoices. Now all I do is, rather than put those sales invoices into PEGASUS as sales, I allocate them on each individual spread sheet to customer and the contract number. From then when a contract clears out, I use that information to prepare the journal voucher which puts sales information into PEGASUS. Now in turn, I get my sales information from a system we use called PROFILE, which is a very old database program. What happens there is that sales invoices are put into profile every month the girl who uses PROFILE, Kirsty, produces a sales list for me which then goes into EXCEL, which then lets me make my sales journal voucher, which goes into there.

What's the interface relationship between all of these with the Redthorn system then?

None at all.

So, this doesn't get any information from the Redthorn at all?

No. These are all on stand-alone PCs. There's no integration.

How long have you had all these various systems?

Since I started which was a year and a couple of months ago, and I would imagine many, many, many years before that as well. I mean the PEGASUS program we're using is actually dates back to when the company was MacGregor Naveer, which is like dating back to 1982.

So, the Redthorn's come since all of these then?

Yes. The Redthorn I think is only about 2, 2.5 years old maybe 3. It was here when I started obviously and we were having hideous problems with it the. We still are, but we're hoping to get that sorted. Never mind, anyway. Back to the accounts, I have wages information. We have a system which we've had written for us; it's only a little program. We just call it the hours program. Now what that does. Again it's on a stand-alone PC. What that does, that takes the daily information from the guys on the shop floor of what job they've been working on, and which, I mean how much time they've spent to each job. Now this program here then produces a job costing.

Where does the information for this come from then?

Well the information for this comes from the physical daily tickets that the guys fill out. Every guy out there, every day fills in a daily ticket like that.

Is any of this information also entered into the Redthorn?

Yes. This also leads into Redthorn. Now this is where Redthorn is supposed to help us because we're supposed to use our costing information, we're supposed to be able to take costing information from Redthorn for, if you imagine the way we work, we have all our sales, we'll have a contract number, say works order sales. That identifies a contract. We'll have all our sales invoices which comes from, well sales invoices are generated and it comes through profile and it comes into my Excel sheet, which then gets posted into PEGASUS eventually. And then the hours information. We'll have all our costs and of those costs, labour is quite a major one. Now that information comes from the daily tickets. Now ideally the daily tickets would go into Redthorn, and Redthorn would give us a job costing. But it doesn't. We have problems the way the system runs.

Is that your deficiency or just the software?

I'd say it's a bit of both. One of the problems we have, and I'm not sure if it's a software problem that can be corrected, is for example, we give a contract 1 4-digit works order number, but the guys on the shop floor take their costing information from the job cards that are produced. Now one works order number, say 5111, may have numerous job cards. So, at any time, if I wanted a job costing of 5111, as far as I'm aware, I can't just put 5111 in, and get a full job costing. I'd have to find out all the corresponding job cards, pull all the costs, and then I've add all those costs together, so, to be honest, the way it's working at the minute is we've had problems, and I don't think the data gets put into Redthorn very well. And currently.

Why is that do you think?

I don't think there's an understanding of the importance. I'm not pinning blame on anyone, but the girls down there who put the information in, I don't think there's an understanding of the importance, and I think there's a lot of problems to do with all the multi-codings. There's thousands of works order numbers like job card numbers and they've all got to be agreed. To get the job card number, the job card numbers are all listed in a book alongside which is the 4-digit corresponding works order. So, you've got errors generated in the guys filling the daily tickets in, that don't always fill them in correctly, you've got errors generated in whoever's checking those 6-digit job card numbers to the 4-digit works order numbers, you then get errors from the inputting of those 4-digit numbers and the 6-digit numbers. You've got numerous stages where basically human error can creep in, and throws a spanner in the works. So, currently, we, the accounting side, we rely on the hours costing which then leads into PEGASUS. So, as you can see, we've got 4 non connected systems all leading into the accounts preparation. And then, for very final accounts, the PEGASUS info goes back into EXCEL. This is the final accounts preparation. So, PEGASUS produces a set of accounts which aren't in a particularly good format. And they go back into EXCEL, which is where we do final accounts and our budgets. The system we've got PEGASUS, it's quite awkward at the minute to design the forms the way you want them, and to design your budget reports. So, it's easier to set up an Excel spread sheet.

How is the information transferred between these various packages?

Well, from PROFILE, I would say it's all paper transfer.

So you've information printed out on a bit of paper is then re-input into EXCEL?

Yes, it's re-input into EXCEL, and then EXCEL does a print out which is then re-input into PEGASUS. I would say all of these functions here, you're looking at.

There's no electronic transfer at all?

No it's all paper input. Now in fact hours into Redthorn, that's all paper input as well, 'cos it's from the tickets. There's no electronic input at all.

Is this hours, is this stored on a computer package?

This is on the computer down the bottom in reception.

So, they'll get the tickets in then from the shop floor, they're entered into here?

Yes.

Are all the tickets also just be directly entered into Redthorn or will they come from the hours program into Redthorn?

Sorry, yes, I see what you mean. No, technically there's no entry from the hours program into Redthorn, but the same information.

So, you've got 2 arrows flowing in , in fact.

Yes, really, You've got your daily, your tickets, and they also flow into Redthorn. Now when we've checked this, because technically, you should get exactly the same result. When we've checked this in the past, we don't. We weren't coming anywhere near, which is why we decided that for our purposes, the accounting purposes, we would stick with the hours program. As far as the production side's concerned, to be honest I'm not even sure if.

Do you know why that was you got the differences?

Again I'd say it's down to human error in the input, and probably attitude towards doing things correctly in the first place.

How much of there of a problem is there with the integrity of data when you've maybe the same data stored in different places on these different packages?

Well, from the sales list, again the stuff that's input on PROFILE is checked by the girl who does it. She also has an Excel spread sheet and she regularly checks the data. Every week invoices that are input are input on PROFILE and she add lists them, and she does another spreadsheet which cross, does all the cross adds and checks the VAT, which is something I've set up recently, and then that ensures that everything she's put into PROFILE is correct, because we were having problems with the invoices being put in incorrectly, which I wasn't finding 'til I was doing my VAT return 3 months down the line. So, we've got checks there. The PEGASUS side, the purchase invoices, we have checks in place for that and that the girl does batch totals. As far as the EXCEL stuff goes,

What about the data transfer, that you've input the correct data from here that was output from there?

Well really, the main check there is when we come to do our final accounts and we go through and have a look. I mean to be honest, there's errors get in. I'll make errors, and you generally don't know until you check your accounts. So, errors do creep in. Yes, you cannot not, there's always, your always going to make the odd mistake every now and then. Well fortunately, it, when we do a journal voucher, a journal voucher in itself is self checking in that both sides of your double entry have to tie up, but that's about it really.

Problem of mis-mash. How ensure main data used when stored on separate system? Alternations. Change both., Updates.

At the end of every month, I tie up the major figures that I can. If it's on my EXCEL spreadsheets, I physically agree the PEGASUS to the EXCEL and make sure there's debtors information, there's the part sales information, there's wages information. I always make, even in the fact that the PEGASUS itself is modular. For example, the wages is done on the PEGASUS pay roll module; it doesn't post automatically to the nominal. I take a physical print off and prepare a journal. But where possible, everything checks. I check everything to everything else at the end of a month as much as possible.

Stuff like this, the error usually crops up, I find it in PEGASUS, and them we correct the EXCEL or the PROFILE. For everything I do, is recorded by a journal voucher. We always have a full order trail or PEGASUS. We can always stuff back. It is long-winded, and this is what we're looking to change. Now we're looking to go for SAGE on a network for the accounts information.

The current accounts, that's not on a network.

No, it's not on a network.

So, how many versions of PEGASUS do you have then?

It's all one version, but PEGASUS is currently on 3 PCs.

How much of a problem is it?

None at all.

Transferring data between those?

Well, the way it works is the girl in the purchase office has PEGASUS on which she uses and prepared the purchases, runs the creditor's ledger on. Now there's no electronic exchange of data. So, I prepare my creditors and my purchase journal vouchers from the print-out she prepares, which then goes into my nominal ledger on PEGASUS.

Could that in theory if you had it on a network, all use the same thing?

Yes, this is what we're hoping to do. What we're hoping to do effectively is what I have here, is have this all of this on one network. No, not only that, but one package, because the SAGE package we're looking at will allow us to put the sales invoices in and post them directly. It allows us to put the purchases in, and post them directly, it does the payroll and posts everything directly to the nominal. So it cuts out all the paper entries as well. It cuts out me having to take the sales list, prepare a journal voucher, and the put it into PEGASUS, because the girl just puts the sales invoices in and bang they come straight through to me, and in addition, the EXCEL packages because we'll still probably be doing reports and stuff like that, the EXCEL packages themselves are compatible with SAGE software, and can pull the data out. So again, it's all electronic transfer. There'll obviously be controls on who has access to what and where. It'll basically be me and the managing director Paul Brown will have full access, and the girls will only have access to, well Kirsty will only have access to sales side, and Michelle will only have access to the purchase side.

Would any of the same information that's on here be also stored on Redthorn?

None of it at all. The only data that goes into Redthorn as well as our accounts system are the daily tickets, the hours. Ideally, Redthorn could produce the sales invoices for us as well, but it doesn't.

Why's that?

I don't think the prices are set up properly and I don't think it's very flexible for handling some price changes or the odd invoice where you're just charging someone a bit extra. It doesn't cope very well. So, currently, what happens is the delivery notes are done on Redthorn which clears the stocks and sorts out that side, but that delivery note is then manually costed up, which then goes through to have the sales invoice produced. It works. You say it is a mis-mash, but it does work. However, I'm certainly pushing for my department, which is obviously the accounts side, I want us on a network, I want us on one package, if nothing else it makes my job easier, and it should make everyone else's job easier. There are other advantages to getting this new system that the level of detail we can input on sales invoices and purchase invoices is that much greater. Instead of getting a query and having to track all the way back to the physical invoice to see what it was, we just pull it up on the screen, no problems.

Were these things here, EXCEL and PROFILE developed by you, the company.

PEGASUS has always been here obviously and it's an off-the-shelf package. PROFILE is a database program they've obviously had somebody in some time who's set up the front end. It's not even registered, but you didn't see that. It's obviously been set up some time in the firm, and it's just a box standard database management program really that has the reports that we need set up on it.

So the sales information is entered on here. Where does that come from?

From the actual sales invoices itself. The girl every week gets a pile of sales invoices.

And where do they come from?

They're what's actually generated by the contracts department.

Is that from Redthorn?

Indirectly, what you get is a delivery note, which is then priced, and then the invoice is typed, and then the accounts copy is input to PROFILE, and that's it.

Delivery note?

That comes from Redthorn when the goods are delivered? And this is the sort of thing I get. I get a sales list like this. At the end of each month which has got like a month's sales on it, and then these totals here for my journal voucher which go into PEGASUS. And that's it. Sales are in. Now obviously, I'm hoping that if we get Sage. I mean for a start SAGE is actually capable of printing the sales invoices, which makes it even easier, because we can print the sales invoices, and the post them directly.

Can that be done in Redthorn at the moment as well?

Redthorn can produce invoices, but I don't think it's set up effectively to do that. I've got a file here of Redthorn sales invoices. Now ideally these should tie up to what we actually have as a sales invoice, but what we get is sometimes they are wrong or haven't been updated, or put in as a penny just to get the details in. So, I think, we have a problem that there's a lot of data that's on the Redthorn system which could do with being massively updated to get it to be effective.

How were these developed, for individual requirements?

Yes, basically. To be honest, it's the way the IT strategy is at the minute. It's a case of we need this, go out a buy it. We need this, so we'll sort it, which is what I'm trying to get at. It's sort of, although I don't have any power in the buying or anything like that, It's sort of come down to me to advise Peter and Paul on what's happening, whether or not the take that advice is obviously their decision, but I'm the one who's instigated the purchase of SAGE or the possible purchase of SAGE which we're busy looking at, at the minute. We've had a few quotes in, soon we'll be going to see a full demo of the system working.

How much of a problem is it having to re-enter. Will you need to re-enter if you got SAGE any information from Redthorn?

The only thing that we still need to do would be the hours, the job costing, unless we find, even if we find another program that will do it, it still needs to be done. We're not prepared at this minute to rely on Redthorn for the job costing information. But hopefully all of this side here will all come under one package, one network, save a lot of paper transfers, print out times, and hopefully, it will make things a lot easier for us.

1.1 Paul Brown

Background about how you went and got the current system, what you think are its strengths and weaknesses.

This is the Pegasus system?

Well, maybe some of your views about the Redthorn system as well, and the Pegasus system, and other little bits that you use, because I've just been speaking to the other accounts guy.

We'll start off with the Redthorn system, because the accounting function does not rely in any way, shape or form on the Redthorn system. That system was purchased purely as an aid to production. At the very outset, whereas the Redthorn system does have certain financial functions, it was very clear at the outset that the software hadn't been written by an accountant, and it didn't incorporate all the necessary links, tie-ups and reconciliations to enable the reports to be used as pure accounting reports and for accounting purposes. The main purpose of going ahead with the purchase of that system was to assist the production and production planning. It incorporated good estimating information, the shop floor planning and creation of the job cards was immensely speeded up by the Redthorn system, and was probably the major reason why we went for it. At the time we were busy preparing job cards and one particular job would take about 3 weeks to manually write out the job cards, whereas if we got it onto a PC, onto a computerised system, the job cards could just be churned out in a matter of hours, and that was one of the major reasons behind going ahead with it. In addition to that, there was interesting and useful features on the system with regard to purchasing, with regard to capacity scheduling, with regards to various reports which the Redthorn system threw out. The purchase manager had difficulties initially in operating the system, but as a company, we are getting more and more proficient and are tending to use it in the way it's meant to be used, I'm sure the purchase manager is getting some benefit from it now. On a personal note I've stepped back from it because whereas we were trying in the early days to take information and transport it into a sensible accounting figures, we couldn't; it wouldn't work, and we abandoned it in a very short space of time. The reason we abandoned it was, one, we had some purpose written software for the wages costing which basically created two very important documents for accounting and control purposes. One was the wages costing. This specifically written software, it manages. It might not be the best, it might not be the quickest, but if we input the hours properly, it gives us the reports we need to prepare, one a utilisation report at the director's review each week to ensure that we're achieving the right level of utilisation that we intend to, and, secondly, the information can be used for all the wages costing for the work in progress. The information from that system is reconciled with the payroll and incorporates the journal voucher for that particular week. We do have problems with this specifically written software. It was written by compusolve, a company that we've dealt with for a number of years, but there's something not quite right in the system and it often crashes which causes young Joanne problems. She sometimes had to re-input the hours, but generally it gives us, I mean Joanne's a low cost area to ourselves, and we can get the information at relatively low cost to the company.

Is this system, does that pre-date the Redthorn?

Yes it does. It's the second purpose written software that we've had. When we first started off as Renown Engineering, we had some software written, and again that had inbuilt problems where it used to crash. The second attempt to get some new software was because the company had to grown out of all proportion to what the original software was written, and, as I say, it works, but it has its problems. Having said that we can cope but it would be beneficial if there was something off the shelf we could buy which could give us precisely what we want. So, that's the system in there. The PCs that are in there with regard to the word processing, spread sheets, everything like that works fine. You know, we can get really good quality reports, good quality letters, notices, and the equipment, as I say, serves us very well in that department.

The PEGASUS software that we're using was originally purchased in 1984. It was when the company before we owned it, had first moved into IT and purchased a PC. The PEGASUS software is broken down into 3 elements - payroll, nominal ledger and purchase ledger. The payroll is very simplistic, easy to operate and easy to understand and we have no problems with it. I doubt if we replaced that

that we would be getting very much more that what we're getting, shall I say, very much more that what we need. The payroll system is excellent, it gives us what we need, and, as I say, it's simple to use. The only problem is, it's a bit out dated now. And my concern's with all the PEGASUS software is what happens at the millennium, we don't know. As I say, I don't really have a problem with payroll. With purchase ledger, purchase ledger has its limitations. The biggest problem is that there's insufficient space to put the input against each purchase invoice we're putting in. We can either on a remittance advice to a supplier tell the supplier what his invoice number is, or we tell the supplier what our internal reference number is. If we opt for his invoice, we would the have difficulty re-tracing our internal reference number. Therefore, we've opted to go for our internal reference, and if that creates a problem for our supplier, he has to ask us specifically what invoices we were paying if it doesn't tie up. Other that that, this system again gives us adequate information for accounting purposes. The reports are pretty good, they're concise, we get a full analysis, and with the right checks externally to the system, again it gives us what we need. There are systems available now that would give us more information which would be useful and possibly save time if we are trying to find out. If we were looking in nominal ledger for instance, and if we were looking at a nominal account, let's say work in progress. In the nominal ledger from the purchase ledger system, it would only give us one figure for a month, whereas there's new systems which would break that figure down if we needed to go into that depth. On the other side of the coin, if we do that work, we're going to have more input time, obviously to provide that information. But, as the say, the system's been working for 12 or 13 years, and it gives us what we need. Currently, the payrolls are paid by the BACS system, and we're looking at a new banking system where we could electronically transfer the information from the payroll through the BACS from a terminal here within Renown, we could do it through a modem. The same would apply with alternative software with the purchase ledger, but we can't do it with the existing software. And really, that's all we need to say about the purchase ledger. It gives us adequate information but we know that there are better products available now. And again, we've got this problem with the millennium; we don't know what we're faced with when we go to the year 2000.

The third and last element of the PEGASUS software is the nominal ledger. Again, a nominal ledger, it gives us adequate information to prepare timely management accounts, the input other than the basic data is very very easy, the system's simple to operate, and, as I say, it doesn't give us any problems really. Again, the main fear with existing software is what happens in the millennium, but the nominal ledger, as I say, it's easy to operate, it gives us a profit and loss and balance sheet, and then we prepare our management accounts from that. It's adequate, although I'm sure that there is better software on the market now that would break down the monthly figures to a further degree which would be useful, although it's not absolutely necessary.

What about the bits, I noticed you had some bits where you used some further processing in Excel and things like that. You had some little bits on spreadsheets on Excel where you transferred data from PEGASUS.

From the budgets?

Yes.

On Excel. I'm not 100% with you here. I'm not sure what system's you're on about. On Excel though we have our budgets what are broken down month by month over the year. And we transport the PEGASUS information into Excel to give us the management profit and loss accounts, balance sheets etc. for review and investigation, but as it's the information from PEGASUS is fine, the Excel supports that and gives us the management reports which we need to control or improve our business.

What about, if you got a new system, about data transfer, if you've got previous historical data stored in PEGASUS?

It wouldn't be a problem, because basically if we've got a new system, the ideal time to commence with a new system would be new year, but we're rapidly running out of this year, but even if we did it mid year, we can bring a brought forward figure from PEGASUS and just include it, and all the PEGASUS information would be retained on the same basis as it is now anyway. There's not volumes of data that would need to be transferred, and I think on, first of all, nominal ledger, it's just a question of transferring the balance across. The payroll, again, it's just a question of getting up to date information and entering the relevant information on the new PC. It would probably be advisable to start a new system with a new tax year, and avoid any problems that way. On the purchase ledger, I think the easiest way to do it would be to allow the existing purchase ledger to be fully paid off and cleared off, and start on a new purchase ledger system on a new system. The transfer of information or data, financial data, wouldn't be a major problem. I would say the whole lot could be transferred comfortably by one person in a day.

How much of a problem is it, the situation where you might be printing out information on a sheet of paper from one part of the system and re-inputting it into another package?

The main area where that happens is where Joanne is putting the work tickets into the Redthorn system where she uses the 6-digit job card number and the number of hours a man works. She's inputting that into the Redthorn system, and then she takes the same job card and has to convert the 6 digits into a 4-digit contract number which our work in progress ledger can cope with 4 digits. There's a lot of duplication on her part and there's quite time consuming, but at the same time, she manages to keep it up to date every week. She doesn't have so many other duties that this work can not be done. It is a waste of time, to input the same information in two different methods, but the benefits that we get from it, and allowing the benefits of the Redthorn system to be achieved by Peter in his production department are well worth the effort. It would be much easier I must admit if we had one system at numbering and inputting hours, but the respective systems can't cope with that at the moment.

1.2 Girl in purchasing

What bits of your operations do you use the computer for?

I use 2 systems to do the purchasing. The material, bought finished goods, fastenings, are all on this one. I think you've been speaking to Gavin about this haven't you.

Yes.

So, we just use this one. And then we've got another one which is that one which is for the tools, transport, mainly consummables. Right, so this one's mainly used for the light consummables and the transport.

Why do you have the 2 separate systems?

Well, we had this one first of all. We started off with this one and then Redthorn came in and its we're having developed like everything has to have a code on Redthorn and we haven't actually developed any codes for these yet. So, I mean it would be easier for myself if like everything was on one system, because at the moment I have to keep swapping between the two.

Do you have to store the same data on the two?

Yes, it's all like Redthorn's stored on a file server and this is on there as well. So, anybody that's got Redthorn can actually get in there as well providing I'm not in it.

How much of the same information, do you have any duplicate information, so this purchase order would be on Redthorn as well?

Yes, we used to because we had problems with codes and everything, we used to put them on here and then transfer them when they came in, but it's not done any more. All of the orders that go onto Redthorn are actually on Redthorn.

Which one do you use, which one's the main one you use. Is it this or Redthorn?

This one, mainly because I deal with the consummables all the time. I mean I have to go into Redthorn well to do the orders for David.

He's the one who uses the Redthorn?

No, David doesn't actually, well he doesn't have Redthorn on his computer, so, but it's like, all of the orders he does are on Redthorn, so I have to keep swapping between the two. It is a bit of a pain sometimes, like if I'm in the middle of something.

Which package do you think's better?

Um, well they both have their pluses really. I mean, this one you can put more information on the purchase orders than you can on the ones for Redthorn, but I mean, it's easier to find information on Redthorn than it is on here.

So, there are pluses and minuses of both?

Yes, I mean I'm not bothered either way which one we use really. It just would be nice to have them all on one system.

Could you just use one package or not, or are there things?

Well, I think when we first got it, it was going to be everything went onto Redthorn, but I don't think. I'm not sure if anything's been said about putting the consummables on and everything , so I don't know.

Do you know if they could be done?

Well, providing there were the codes available, I can't see why they couldn't be, but I mean you'd have to have absolutely loads of codes for all of the consummables.

So, it's a coding, is the main reason why they'll still a separate thing?

I think so, I'm absolutely not sure, really.

How would you basically go about and use this system then?

Right, well, I mean the instructions are really on the bottom for what you need to do. So, if you want to find a supplier, it's just like it tells you there. So you SE, and then it's SU for your supplier, put your back slash in, and just type your supplier's name in. The same way with an order number, you just type ON, do the backslash, put your order number in. So, I found it a bit confusing at first when I first started but now it's just like riding a bike. So, as I say, this has it's pluses and its minuses really.

So, at the moment, you separate it between one aspect of purchasing and this one then, and the consummables on this one?

Yes.

And other sort of stuff on the other one?

Yes. It's like raw material and everything.

You wouldn't have a problem like with having to duplicate it on a either system, so you never do that?

No.

It's strictly a rule that one stuff goes on one, and another on another.

Yes. It's like all the stuff for the jobs, like subcontract orders and everything go on Redthorn and it's just the stuff like drills and things and transport go on here. It's like cleaning equipment and everything.

So, basically, it's a strict, do you know if what problems it causes not doing these as part of Redthorn? Does it cause any problems?

It doesn't cause problems. Well, it hasn't yet. There are the occasional orders that do go on here, like subcontract ones, but then when it comes to booking them in, I just transfer them straight across to Redthorn.

And the other one is used on Redthorn because it has, you know, there is less of them and it's easier to put the codes.

Yes.

It's really a coding problem, isn't it?:

Um.

Would you say that's the main reason rather than ?

Well I'm not sure. I thought it was mentioned when we first go Redthorn that everything was going to be put on there, but as far as I'm aware, nothing has been done about putting all the consummables on, and I'm not sure if there's codes available really, because I know for like materials we're up to the end of the alphabet actually. So, I'm, not sure.

And the main problem is like having to, is it two things?

Yes.

1.3 Contracts manager

What computer systems do you use as part of your job?

Well, the Redthorn system for the production of the job cards and I've got my own PC which I use for just purely the contract management side, producing statistics, or status of a particular contract, and that's virtually what I do on the PC. That's all.

What sort of packages do you have then apart from the Redthorn?

Well it's, we've got Microsoft. I use Microsoft works, but I'm going to have to over go onto Excel I think because everybody's using Excel; apart from me. It'll be the same sort of thing; I'll be using the spread sheets.

Are these just for little things that you've developed these yourself?

Yes, a lot of them are, most of them are just so I've got a up-to-date record of the current status of any particular contract, but there are 2 larger spread sheets which are for distribution to the MOD, which is, once again, it's a status report on the contract for two particular contracts.

Now, where's the information for those spreadsheets come from then?

The information comes from any paper work, delivery notes, that's generated throughout the company. MoD forms that are raised, we have a delivery. MoD deliveries are done on what's called 640 forms. So, they don't put any importance whatsoever on Renown delivery paperwork; it all has to be done on an MoD 640 form. So, just to maintain the records of which 640 forms are relevant to which particular job and things like that.

Would any of that information come from the Redthorn system at all?

Not on the 640s, no.

What about anything in any of your spreadsheets?

Yes, the delivery notes, the delivery note numbers, and the advice note numbers, they come out of, that's just a generated number out of the Redthorn system. And on certain of the contracts, the ones that I feel need monitoring or they need a little bit of control on. For example, if we have a job, we get a job for say 100 items, and delivery is over a period of 2 years, I maintain a record of every delivery, so we can then relate the advice note to a particular delivery.

Would that be kept on the Redthorn system as well?

No, that would be kept on the spread sheet.

Can you do that on the Redthorn?

I don't think so. It's probably there on an advice note in the advice note menu. I think you could possibly pull it off, maybe, I'm not quite sure to be perfectly honest with you. I'm not quite sure whether it would be in a simple enough form.

But how much of your information in your various spreadsheets, how much of that is shared by other users?

Other users? Possibly purchasing, production, and certainly inspection, because at the start of a contract, I might lay down the bones of the spreadsheet, with a load of gaps in for deliveries, quantities, numbers, this that and the other. But the actual production of a schedule, a delivery schedule, whatever you call it, or production schedule, is there. I'll also maybe put onto this spreadsheet as an aide memoir to me when I look at it, that oh there's more job cards to be issued. So, in that respect, it's a little bit of production control.

How would that information be transferred to the other people?

That would only be by a copy, just a hard copy, which isn't maintained. I don't keep sending them hard copies every month. What I have got, is that I keep an up to date hard copy file of the contract status reports. So, if the inspector for instance wanted to go in and find out a warrant number off a particular job, he could go in to the hard copies, it's just there. That's just kept at the side of my desk.

Do you think the other people, that you transferred that hard copy for, do you think they'd use it in another computer system that they've got or not?

No, I don't think so.

Would any of that information need to be entered in Redthorn or not?

No.

It's just specific?

It's purely contract control so we know exactly where we are on a contract and, as I said to you before, as an aide memoir when we look at it, I'll see a date, and I'll say there's got to be job cards done for that date. So, we know we'll get the next batch out.

Is this something that's specific to you, it's not part of Redthorn. You had to add it on really because maybe Redthorn didn't have that facility.

Yes. Certainly on the long term contracts where we get a contract that's maybe going to run for 3 years, and the customer wants the quantities delivered in batches on particular weeks throughout the 2 years, I then plan or produce a spread sheet whereby the deliveries are marked, when we need to issue the job cards, when we have to deliver, and I maintain that by just continuing advancing when they were delivered, and what the delivery note was.

Do you need to transfer information between your spread sheets at all or not?

No. Just one particular spreadsheet for one particular contract.

So you don't need to swap stuff around?

No.

Or pull off reports or anything like that?

No.

There very simple little things presumably.

Basically, yes, very simple, very simple, nothing clever about them at all. It's purely to, initially it was for my own good when I was given control of all the contracts here, it was just too much to commit by hand if you like and some of the contracts became too big to just allow them t flow through the system naturally. The smaller jobs, you can issue the job card, and it's just going to go through the system, and then your going to get advice note and you can invoice it. These ones you need a bit more control, especially when with amendments to the orders, it's got to be the quantities and dates, and whatever's got to be maintained.

So, who develops all these spread sheets that you use?

Me. I just did.

You'd really done them, instead of like doing the job on paper?

Yes, because of on paper, it would have just been horrific, because of on one particular contract, because of the changes, I can then just maintain it as per the order amendments, so at any one time, any one date, the speadsheet reflects the situation, the current situation, rather than all the scratchings out on a bit of paper.

Would you use Redthorn for any of your activities, or do you mainly use spread sheets that you've done?

I mean I use the information in Redthorn when its time to produce job cards obviously, and that'll then be put in your particular spreadsheets for job cards. Well, I would make a note that they'd been issued, I would put in that they'd been issued.

Otherwise, you don't use them?

Integration between Redthorn and what I do on spread sheets, there isn't anything. There is nothing that I sort of pull out of the Redthorn memory and transfer it onto one of my spread sheets.

Presumably, that's because it's not part of your job?

No, well, I don't know whether I could.

Would you get any information from Redthorn from hard copies at all or, not electronic transfer?

No.

What do you think of the current set up then - Redthorn and your spread sheets?

Well the Redthorn system from a production control point of view is good, for what I do, producing job cards, for a job, we couldn't have managed without it, because it, when I first started all the job cards were written by hand. So we can generate hundreds of job cards in a day now, hundreds, which would have taken weeks to write, and the more, you can put more detail on the job card with using the Redthorn system. And once it's there, it's a case of maintaining it. So you have a part, if there's a change in the part, you know it's up to, you can go into the system, update the drawing, issue number, make any changes to the planning that's needed, and it's done. I mean then it's just a case of a minute entering information and you've got a job card out. At the end of the day, as far as producing job cards is concerned, it's been a bonus for us.

That's the Redthorn system?

That's the Redthorn, bonus, it's wonderful.

That's what you use it for?

We generate job cards. I generate the job cards.

Do you use the Redthorn for that. Where do you get the information for the job cards from? Would that be

That's from the estimators, Eddie and Paul. Job cards split into two sections, really. Three sections. There's the order details, there's the material planning, and there's the labour planning. Eddie and Paul, the two estimators, they look after the planning side. When an order comes in, I will enter the order, so that information comes out on the top of the job card, but the planning is already in, by the time I enter the order, they've created the internal reference number, and you just enter the quantity, the date required, purchase order number, customer's order number, our works order number, bang.]

Do they input that information into Redthorn?

That goes into Redthorn.

And I come along, we've got an order for this. If for instance, we haven't done the part before, it's a completely new part, I would get a purchase order, I would log the order, and say to the estimators, I need the planning done for that. The planning would be done, it would be allocated an internal reference number, and they'll give it back to me and say that's all ready to go. So I then enter the order details on Redthorn, and print out the job card. But the next time I get it, I don't need to talk to the estimators because it's already there.

When you've actually generated the job card, do you then put it into one of your spread sheets?

Yes, I would put the information in that that batch has been issued, or that quantity is issued for that required date. We need so many of them on that. We might issue a batch of 100

So you just put the batch.

Yes. The job card just gets the job done. That 100 could be split into 2 or 3 deliveries, and it's just to keep a record of it. I just put the job card number maybe into the spread sheet that it's been issued, it's gone to the factory.

Does Redthorn tell you that as well?

It probably does, but it wouldn't tell me which batch it is of the whole contract because the other job cards for the future haven't been issued. So I want to know what stage we're at.

Do you find any deficiencies with the Redthorn system at all?

That's a difficult one because we've had, as you're probably aware, we've had a lot of problems with it, because I strongly believe we haven't as a company been operating the system correctly or accurately enough. And we haven't been going through all the stages if you like that's needed for the system to be maintained and run correctly. But I think we're making this minute a concise effort to try to get it done and Gavin is producing idiot sheets if you like for want of a better word for everyone to make sure that everything gets done. I hope that when that is done, and everybody is doing correctly then from a stock point of view that's the big thing that we want to be working, the stock control. Because at the moment, if I print a job card out, and a particular item of a sub level doesn't come out, I can't put my hand on my heart and say that's right. I can't say, Yes that must be right, it's in stock, I know it's in stock. I can't do that. So, you've got this doubt certainly with production of job cards. There's at the moment there's this doubt that is it right, is the computer telling me the right thing, the correct thing?

I don't think the system's been maintained correctly.

So, may be there could be some bits on there that you're currently doing on one of your spreadsheets to help you with your job that you don't know about?

Maybe. Whether it would come out in the way that I wanted it presented, I don't know. I mean. I would think, yes the information might be there.

What do you think of the current set-up where you use your little spread sheets where you maybe have to get the information from different sources to put in on spread sheets? Would you prefer to have it all just done in Redthorn, or isn't that really a problem?

On certain contracts, I would say it would be easier, it would probably be quite easy, quite presentable coming out of Redthorn; on other contracts, no. You've got to appreciate some of the contracts that we've got. I mean there's one particular contract where I couldn't even use a spread sheet, it was so big. I had to do it by hand. It would just have been print, print, print for Vickers. But obviously, that took a lot of setting up and certain jobs take a lot of setting up at the start. And that's my job really is setting the contract up, making sure everything is in place, everybody knows what they're going to have to do, what has to be done, and making sure that when they want, they've got it. When we need the cards on the shop floor, they're there, they're ready.

Do you think that was a problem with the system then that you found it easier to do a big one manually, a massive contract manually.

Whether it would happen now, I don't know. I might think about a way of trying to put it on the PC, but at the time we weren't working on PCs when I first set up this contract up. So, when I started working on the PCs, it got, it would be 3 years ago, 4 years ago, when I set it up, it would have been harder to midstream if you like to put it onto PCs. It would have been virtually, I don't know how I would have done it, the time to transfer the information and put it onto the PC, and it was all set up, and it's run well.

So your PC things, are they before Redthorn or after?

Round about the same time. When we first got Redthorn, I just had the Redthorn module, and then it was decided that I should put it onto, some of the bits of paper that I was producing by hand, I should put as many onto a PC as possible. Obviously, it's nice if your customer says, well what's the current status of this, have you got information on that, then I just press a copy a send them it. Then it's up to date, it's bang on, it's as of that day. Certainly with MoD, they like things like that.

You say that you can provide the up to date information, does that come in from production?

Well it come in from production, and as the delivery notes are done and the invoices are prepared that gives us that side of it, but that item's been delivered as we produce a job card that tells me that what batches have been issued, so where we're up to, what we need to issue to meet the delivery schedule, the customer's requirements, how many we need to issue, to maintain a reasonable quantity, to maintain the price. You could issues them in ones, it's ridiculous really. We issue them in batches of whatever. And then keep people advised of when the deliveries are required.

Do you get the latest information on it?

Well I see every advice note, everything that goes out of here.

So you can be sure that that's bang up to date?

Bang up to date. Every advice note, everything's that's delivered. I do, because I do the invoices for, the value on the invoice.

And I presume structurally these spread sheets are only on your PC,

Yes

They don't go round to other people?

I think that's one of the things they want, I would imagine networking is the thing to go for, because certainly other people would probably find information on that would be useful. Certainly inspection, because they come in, and David uses quite a lot looking at what the delivery schedule is.

How would they get that information at present then?

They would just go into my office and just have a look at the hard copy.

So, do you think there would be any benefits getting the information electronically rather than on hared copy?

On the network, yes. I would think so. I think we could, my little spread sheets could be developed, any information they wanted to add, I mean some of them are only 3 or 4 lines. So any information they wanted to add, or any notes they wanted to put on, as long as everybody maintained it, or they wanted to have a look at anything. I don't know whether it would be a good idea to have people able to add information to them. I don't think I would like that, I think I would need to know myself, so protected in that sort of way that I'm the only one that can change them, and obviously if they've got a problem with what's on the spreadsheet, then they could come and see me, and we could sit down and agree OK that we'll not do that; we'll do that, and I'll tell the customer.

Do you think that'll improve the way of working if that's done, or rather than the hard copy?

I suppose it might because it saves David walking, if David's in his office doing paperwork, certainly now that his office is up the top,

Instead of walking down to see you.

Yes

Now would some of that, say if people wanted to get some information, from a hard copy, do you think that he might want to enter it into a computer package in his office?

I wouldn't have thought so. David's, inspection's more concerned about making sure that the product's right. There might be information there that he might need to record, I don't know. Serial numbers and things like that, maybe, but most of the information is contained within the contract file. I don't like too many copies of the contract file. I believe that there's. I've always said that the files I produce are contract files, but they're not mine, they're the company's, they're everybody's files., and I've given everybody a section if they wanted in the file. If inspection want to file anything, make notes, keep it for the record, whatever, they can do that. But it's got to be in a central thing, so everybody knows all the information is there, so there's no other little files around the building to do with the contract.

Do you think there could be that at the moment?

I hope not. There'd better not be.

All sort of things all over the place?

There's got to be one file maintained?

I supposed you'd say that for the computer system as well if your things are networked?

Well, that's what I was saying before. I don't think. I'm sure there's information on there that people would like to look at, and obviously if it was networked, there are probably other spreadsheets we could look at, you know. Whether that would be deliveries this week or whatever, you know this week's important deliveries, this week's musts, must go out this week, whatever, there could be something there that could be developed where everybody could call it up and say right got that, got that, got that, but as far as recording information or entering information that's relevant to the control of the contract, I wouldn't want other people putting it in, I don't think.

How do you think this system could be improved if at all?

What are computer system? I think networking would improve it a lot.

What your spread sheets?

The spread sheet thing. I think there's more information that could be committed to computer.

Like what?

Well like what I said. A weekly this, that and the other. I've got a. I do the production meeting, which is probably the biggest meeting which goes on in this company on a weekly basis. And I do 15 copies, hard copies. So every body gets one. So everybody's working to the same thing. Whether that could be done, instead of doing the hard copies, have it transferred electronically so its there to call it up, and by doing it that way, then anyone could enter information onto meeting notes. I don't see that as a control. I see that as an information. All the managers sit round and we decide this is the current state of this contract, it has to be done, this is going to be done this week, we have to do that, so that is a bringing together of information where we set a week's targets, because that goes on every week, a production meeting, and we discuss every single contract, no matter how small, every single live contract. I might only be a second, but that's OK - that's going through, that'll go tomorrow.

Can it save your time at all producing hard copies?

Well not my time personally, but I take the minutes, I amend the previous meeting's notes, I give them to the girl and she's got it on PC, it's on WORD or whatever I think it is. And she produces a copy, I check it through, and then I give it back to her, and she ticks all the copies off. We're talking about 15 copies all told. A bit laborious, but I think it's proved it's worth, because I said that we should have a production meeting when we started to get some of these bigger contracts in, and I think Peter and Paul have realised how important the meeting is. So everybody gets to know what's going on, what's going through, what the current status is and anybody that wants a note added in.

Could the computer save that do you think by having that information available electronically to everybody, so may be save that meeting, if it's available on the network as you say?

I don't think you could save the meeting, because I might say we need 48 of them, Stevie might say, well we've only got 32 ready, what can we do and we decide round the meeting, right OK we'll hold back on this contract, and we'll push more people onto that one. We'll put a bit push on this, this week we must do that, so there's a lot of priorities if you like I set which I don't think you could sort out electronically. Not just priorities but because something becomes a priority there, it's nothing to do with the priority on production mightn't mean anything to purchasing because it could all be free issue parts, so you've got to just get. We decide what the priorities for that week are.

(Demonstration in office)

There've been changes, so you can see there's been a lot of changes. Each one of these lines represents a particular item, and that was the delivery schedule 144 off on that date, the yellow is when the job cards have been issued, the reds when it's been delivered, so it's gone on for a total of 293 items. So that was set up back in end of 1994. This was all done and prepared. Well you can see to do it would have been a large spread sheet .

You didn't have a spread sheet then presumably?

What I have got is. This is the same contract. That's the state. We've got a works order number, drawing number, the total quantity, value, the total value, the quantity delivered, the value delivered, outstanding quantity, the value outstanding.

There's a lot of number crunching presumably.

Down at the bottom is

I suppose it's quicker for some contracts to do it, it's quicker than doing it all like this?

Yes. But, I ,mean it's this one as well that was a long term one. And this was done by hand, each one of these are an item, which has to be issued. But this is a whole assembly, so this is just a job card issue schedule, so I want top know when I'm going to be doing job cards and what's been done.

And this. You just set your spread sheets up to look like these really basically?

Yes. These are the 3 big contracts. 7000 series.

What about the reporting from those things rather than a spread sheet? Is that easier or harder? If you had to do reports for the meeting or whatever?

What I also do is produce a. We've been able to pull out what's required for week 4, but then it gets hard, because then you get Vickers coming and saying look we need a stack of items, can you just deliver all of the outstanding quantities before Christmas 97, so really how you would have maintained it, I just don't know, other than this. And I know just by putting little cryptic notes on, so we can deliver these by Christmas 97. The fact that they're not wanted 'til week 34 98. They've just said, can you do that, will you do that. Will you manufacture 20 sets of them and hold them, I don't know whether we want them yet, but if come Christmas we decide we don't want them, we'll accept them anyway, but we might want to send them to Leeds, in which case it'll be another order. How you keep control of that, it's ....

You can't really do that on a computer package at the moment.

No. So, a lot of it's by hand you see. This is all just delivery stuff from the first week, week 6 1995, that's what was required that week.

You still do by hand then?

Yes. We still do that, because that just comes off here. Because very early on, I did when the job cards have got to be issued. So I know that we've issued all the job cards for delivery up to week 8. I've got week 10 to do, I've got week 10 to issue this week. So, that's the delivery at week 10. And that's all that's outstanding. Hardly anything that's outstanding now. But these are the types of things that I do on the spreadsheets. This is what turntable enquiry for Vickers.

That's from a spreadsheet then?

That's from a speadsheet. So we've delivered 151 out of 154, and that's the schedule.

You print those off each week then?

Yes. Well I maintain them and print them off when, I still maintain the hard copy, that's the one of MoD, that's the warrant number, the quantity, the date of the warrant, the date we received the equipment for refurbishment, the date we dispatched it, and the 640 number. So we get paid on those numbers. And then things like the road wheel contract. We get 4 GINS from HDA, forget those 2 now, we've finished with them. We send machine 4 GINS to BTR, and they send them back to us rubbered. The wheels, and then we deliver them to Vickers. So, these are old orders. So at the minute we've delivered 1191 to Leeds, 1176 to Newcastle, and 255 the backer. And this another one that I've done. This is the delivery schedule for road wheels. It's a revised schedule for Vickers June 97. So that goes all the way down to 14th March 2000.

So, all you would use these for, these would count up information how much you'd got delivered that you'd have to count up by going 1,2,3 on these ones.

Yes. Well, I've got this one, this'll tell us how many's delivered, that's quantity delivered, that's the quantity ordered for that item. We've got 113 on order, that's the value, that's the total value, we've delivered 84, so that tells us exactly how many's outstanding. That's another MoD contract. This is for Vickers. This is another 155 off which started back in 1996. We've delivered 69. That's the advice note number Vicker's Leeds top decks. That's our serial number on the top deck. All the schedules laid out, coppers. So it goes. Most of them are the long term contracts. That's an MoD one that was a 640 number, packing date to the MoD, external fittings, that's all been changed This is where we've got a little job. Support arm's required there but tells me there that the job card's been issued for the full batch. As I say, it's just an aide memoir so

Instead of writing it down, you just do it on the spreadsheet.

Yes

These presumably don't do any number crunching. Are there any number crunching on these ones?

No, not really. Just other than total.

What's the main number crunching then on the spread sheets that you use? Just totals at the bottom?

Just totals, yes. No percentages or anything like that.

Down here. The final column. Presumably somebody will come in and tell you by whatever means that they've delivered that number of quantities or whatever. So you just enter that in and update your spread sheet.

Yes.

Then it's automatically totalled down there?

Yes.

And then the same thing.

Received.

Received. I get a warrant number once I get a form from the MoD that tells me something's coming, that this is a warrant. So I enter the warrant number, 1, and the date, and I know that we've got 45 warrant numbers. I know we've received the items. So, we've had 45, we've delivered 41, there's been 2 scrapped off, and there's 2 that we've received. And the production meeting you see, this is where we go through every contract. We just amend it on a weekly basis, and decide on any information.

Then you just get these numbers from your spreadsheet then?

I just maintain them. Any little notes. US navy form that's been sent away for signature. They're crossed out and they get entered up.

What for this or next week?

For this week.

That's just a spread sheet. That's just a separate little sheet for work in progress on the launch equipment which is an MoD contract, but that's for us.

So this information would come from these things and these things as well?

Yes well, that is that file. That's all, that's just one contract. That's that whole file. So I've said complete up to week 51, 1 item outstanding. Outstanding for week 36, 3 outstructs were awaiting, delivery of the aluminium plates re-scheduled for that, 10 sets of skirting plates. You know, it's information.

The Redthorn doesn't allow you to do this. There's not the facility in it?

I honestly don't know. I would think there probably is, whether it's presentable, or would be presented in a way that would be understandable, easily understandable, I don't know. But these are the 2 other spread sheets that's on Excel that go to the MoD. This is to do with track tensioning wheels. And this is faxed through to the MoD. That's the warrant number which we get in the quantity, date received, and this is where we are saying estimated completion, completion the 640, of comments, so if we look at the back, this is like the current contracts, the current warrant numbers that are still outstanding, so I've got to make sure that I've either got BAR certificates or 640 notes for each warrant number. Keep having them paid off. And the other one that goes to MoD is the, and this goes on a monthly basis, these are all the old jobs, that's a one that's in hand. I just maintain that, and I bring it up to date every month.

Do you maintain that on the spread-sheet or hard copy?

I maintain it one the hard copy, and then I amend it at the end of each month. The reason why I do that, if it was just a case of amending it, I could just do it on, but I like to know what's happened in that particular month. I've got to do more sheets for the MoD. I've got to write these silly sheets out for the MoD as well which tells them how many of a particular item has been delivered in a month. So, I just, I can see when I go on the red, that's gone now, that's gone. But basically that's it.

Estimators

So what computer system do you have then to do your particular job.

Well, we use Redthorn mainly for doing the job cards. I've got another system as well which I do spread sheets on.

What do you do on that particular system?

Well, really, it's just for my own information. Like, we subscribe to this company called sub-contract UK, and I just keep a record of who I've spoke to, when I've spoken to them and things like that.

It's not for like company information.

No, it's

B: We do have company information on, don't you. We have a separate a separate NC shop in to the top unit and Paul's looking after that. And we so the actual order.

Yes, that's right I have got the order log on there as well.

Where would you get information for that from then?

Well, all it is, is it's just like another, like all the orders that we get, the orders go into the order book and I sort of keep my own record of it. We keep it separate from the rest of the work that we do.

Why's that?

Just mainly so I know what I've got up there in the unit in the CNC shop.

Where would the rest of the orders be kept then?

B: Alwin Fletcher (contracts manager) does all of those, Contracts manager. Alwin does all of those and, for the time being, we're keeping this NC shop separate, just to see how it goes actually. We have quite a lot of work for our normal machine shop and fabrication shop but the NC shop is struggling a little bit to get work, we're keeping it separate, so we can keep an eye on, Paul's looking after that.

But ALwyn?

B: Alwyn does the main order contracts, yes. And he has his own spread sheets for that.

Now which particular parts of Redthorn do you, it seems to be then that your spread sheets are basically for personal information then, really. So your main company bit of your job is Redthorn?

Both: Yes

B: The Redthorn on the production of shop floor paperwork is excellent, and it also means that we can trace histories of jobs previously done very very easily through the system. It's a big asset to us. We don't actually do any estimating on the Redthorn, although the facility is there to do it. But we haven't up until now done that. There are certain flaws with it. But what we do is we record any enquires done against the drawing numbers, so that we can trace jobs previously done here. But what we couldn't do is trace jobs which had previously been estimated here, but not orders placed. So now we enter these into the Redthorn system, so that if a job has been estimated, we can find it easily.

Now what do you actually do for estimating then?

B: On Redthorn, we do a manual estimate, we don't use the Redthorn for the actual estimating itself.

So it comes in, then you estimate it manually?

B: Yes, Yes, we do the material pricing and the labour pricing. And then using usually a standard mark-up, we arrive at a price to quote the customer.

And then that's put into Redthorn, it become an order?

B: Yes. If we get an order for it, we the put this labour planning and the material planning into the computer.

Why's the Redthorn thing not good enough for you to use then presumably?

B: For estimating?

Yes.

B: Just, there are certain flaws in it. One was material, where the file is getting built up and built up. So that eventually, we should have a fairly comprehensive material pricing file. But at the moment, that's not comprehensive enough.

Oh I see, you need to build up a database.

B; Yes. The system itself is all right. I've used it before; Peter's used it before. I don't think you've ever used it

I've never used it, no I haven't.

B: So, we should eventually be using that.

Yes, we should I think.

B: I don't see any major problems with it to be honest

Would that make your job easier then do you think?

B: I'm not sure on the estimating side. Peter for some reason doesn't want to use the estimating. I'm not quite sure why.

It's worth giving it a try like and see

B: I've done them on there before, but you get certain flaws with it and we've not really gone into it sufficiently.

Can you compare the results or something?

B: One of the things with the Redthorn system is that you can arrive at different value for a job according to the batch sizes. But that's all determined by putting setting times in against the operations, where at the moment we tend not to do that. IF we're doing an estimate, we basically estimate on the batch size that's being asked for, so we just put a time against each operation without putting a setting time in. So if you really want the Redthorn system to tell you different prices for different batches, you must have setting times in.

Where's the information for all the estimates then that you use at the moment?

B: That's all; filed in the office in manual files.

So you just go into that?

B: Yes. We can find that easily, as long as we know enquiry number, we can find it easily, and that's one of the things we have put on Redthorn against each drawing number that we estimate, we put an enquiry number. So we can go to the drawing number in the Redthorn system, find the enquiry number, then go to the file very easily, where previously you had to go through the files and try and find it, or go through the enquiry book in administration and find it through that. But not very easy, it could take hours that way.

So, that makes it a bit easier using Redthorn then?

B: Yes. Well, you can get it within second, where a couple of hours, it was quite easy, particularly, but it was a very old one up in the archives. But this is something we'd just started and it is good isn't it?

It is.

B: There's no doubt about it.

It seems great Redthorn for doing the job cards and for the trace to see if we've done the job, like the jobs before and that, but.

B: But it is good. The problems we've had with Redthorn are all like launching problems and things like this where stocks aren't true values, which doesn't really involve us. But for shop floor production paperwork production and also tracing jobs that have been done previously, it's excellent.

So, you specifically use, not for estimating at the moment, but job card production?

Um Um, just for producing the job card.

You produce job cards do you?

Yes.

B: Normally, we would pass them over to contracts to do them, but very often because of loads in the department, Paul and I do actually run the paperwork off ourselves, Yes.

If it's a new job, we'll input the information and then I think we're supposed to pass it through to contracts.

B: Normally, we'll pass it through to contracts and they would print the job card, and take the copies off for purchase, and then arrange to get the copies of the drawings printed so that they can go with the job cards in the bags for issue to the shop.

Where would you get the information for job cards from?

B: The actual quantities and things like that?

Yes.

B: The orders would come in and go to Alwyn Fletcher in contracts. He would make a file up, and then pass that to us to do whatever was necessary to produce the paperwork.

Oh I see, producing the job cards and stuff.

B: Yes.

So, you do that from Alwyn Fletcher's?

B: File. He makes a files up, yes for that particular contract. We have a contract review system as well, so when Alwyn makes the file up, we call in Peter Rennie, quality, production, purchase, and we go through it, particularly on the big jobs. So everybody has a little input as to what's required to get that job out on time.

Anything else you use the system for, or is that it really?

Both: No.

B: Not really, no.

Finally, your NC shop thing, that information presumably comes directly from the NC, stuff they provide you from that NC shop. What do you do with that. Do you print that out for management reporting or what?

I just print it out for my own use. Just to see what we've got up there, what jobs we've got and you know when they're due and things like that. So I can see when jobs are due and I try and get them to enter the jobs out and

B: The main reason for producing the spread sheet is we have a weekly production meeting, so we're all involved in this, and Alwyn brings in the main spread sheet with the main contracts on, Paul has the one for the NC, so we gob through each particular order that we do to see how we've progressed. Paul gives a report on how the stuff in the NC shop has gone.

Do you think you could use Redthorn to manage these at all or not? Would it be easier on Redthorn if Redthorn could do it?

B: I'm not sure whether there's any facility on Redthorn. Alwyn Fletcher might tell you better about that, because he started his own spread sheet system Whether that was done because we cannot do it on Redthorn or not, I'm not sure.

Production

What do you use the computer system for?

The only things I've used the computer for is for like launching. You know the level of the job card, you've got launching, we've got a big a level.

Which system do you use? Is it the Redthorn?

Redthorn, yes.

You don't use anything else other than Redthorn?

Computer wise? Just the CAD CAM system we've got at the top of the building. That makes templates and that for the CNC burner.

Oh I see that's like a design drawing office?

Yes.

Do you get any information from there that you'd need in Redthorn?

No.

It's all totally separate?

Yes. I use Redthorn for finding job cards, and drawings or something. It's just basically for the production part of it.

Would you update any thing in Redthorn at all?

No. Just booking things in, and launching them that's all. Nothing really. Very rarely I'd like into it all the time. A couple hours a day maybe at the most.

And that would just be to get the job card in? What's an average way that you'd go about using it then?

I'd just go round the shop floor and the cards, sub-level cards are finished, I'll come in, two one on the computer, book them into stock and then launch them on 01. That's it.

Where would you get the information for that from, from the job card?

All on the job card, yes.

Is the information on the job card, that's already in Redthorn?

That's already in Redthorn, yes.

So, you wouldn't add anything to it?

No. The only thing I do is I'd put a job card details on, it comes up and tells us how many there should be on the job card. And I'd check the job card, see how many I've done, and then just book them in. So, all I'm doing is just putting them into stock. And then I've got to launch them, put them onto the higher level card.

And that's all done on Redthorn?

Yes. Redthorn does it all.

What do you think of it?

I like it. I didn't like it when we first started, but it's a big help to us.

In what way?

Well, it keeps like a paper coming in. When you've got certain jobs, you've got say 16 cards, sub-level cards. But if I launch a big card, it'll tell me which one's I'm missing. So, I can go and find them. It tells us which ones I need. So, it tells us exactly where I'm up to really. Anything I need to know, I just go in and look on computer. It might say, you need 24 of these before you can start doing the next card. It just means I haven't got bits of paper. I just go onto the computer screen.

You don't use bits of paper anymore, you just use the computer?

I still use schedules for like week 2, week 4, for update which one's I've done, which one's I haven't. And then which ones I haven't, I'll just come back into Redthorn and see where I'm up to, and then just do it from there.

Would that information on the schedule also be on Redthorn?

No. It's a separate one. I just like when we've got delivery sheets, when we should deliver and stuff. I mean, it'll have on Redthorn when they're due. But I like to spread them on weeks when I like to deliver them, and just tick them off when I've completed them. It just keeps me a physical record. I can see it all, like I've still got that one to do.

That's all you basically use it for then?

Well, I'm hoping when we get it, we're trying to get it sorted out again. I don't know if Gavin's told you, he's trying to sort it. When he gets it sorted again, he wants to try and use it for production planning. We're trying to use it for that you know. How many hours we've got on each machine and stuff like that.

How would you use it for production planning at the moment then?

We don't. We can't use it at the minute because it's not very accurate. The details on the computer aren't right at the minute. With that getting sorted now. So, hopefully we will be next year.

What do you do for production planning at the moment Is that manual?

Just the sheets. I'm using the sheets. We just do it that way, you know. We've printed one off to see how it would work. IT seems as if it might work, but it all boils down to if the time's on. If the time's aren't right, it's going to be a waste of time. If the times are right, it's going to be a big help, because it'll tell where you're overloading on the machines.

So do you use basic knowledge at the moment for planning?

Yes.

Rather than a machine.

Yes.

Is that good or bad do you think?

Hands-on's better. I mean the machine is good, but it might be wrong. I mean if you tell the machine it's going to take 5 hours, and it only takes 2, you are down 3 hours, or it might take longer. The machine can only do what actual planning is. If the time's not right to start with

You're the planner as well are you?

No. Eddie and Young Paul do the estimating. I just do the production side of it. Get it through the shop and get it out.

You're just controlling the job as it goes through production?

Yes. Eddie and them do the planning, job cards come out, given to me and I'll just get it through the shop and then out the door. Just launching them up on the computer.

Do you think that the computer provided you with all the information that you need, or do have to look up one thing on the computer and then go somewhere else ?

No, not really. I mean, when I put it up, as soon as I see it, I look and say this is getting sold off, so I know where to go, to solve if they haven't been started. And it tells you how many hours they've done on the job. So, if it's got that much booked, I know it's started, and it's just a matter, if it's not at the sole, it'll be at the next operation. Generally I know where everything is. But the system's all right. I like it. I know there's a lot of people who don't, but it's a help to me. The more I'm getting into it, the better I like it. It helps us a lot you know. Just basically tells us where I'm up to on certain jobs. It's a big help.

Would you know that otherwise?

I couldn't remember everything on the shop. I mean there's 65 blokes on the shop floor. They're all on different jobs. I couldn't. All I could on is my weeks. Week 2 I say where's this job, and then I'll have to go and find it. And the computer's a big help. It is to me anyway. It's good for me but, I mean Paul doesn't like it I know, Peter wants to give it another go. I don't know if there's any other system that could do it, that's the thing. I mean we've used this one, and I know it's got it's faults but

How much of a problems would it be if you suddenly changed it?

It wouldn't be any problem to me as long as it could do what this one's doing. As long as I don't loose anything.

The data transfer?

Yes.

Do you go to back information on there at all?

Sometimes, yes. To see how long it's taken to do a job or something like that.

What in the past or?

Yes. All the records is there from the jobs we've done. So you can compare times and see how long it's taken, or if you get a new order in, and say that wanted it quick, you could see how long does it take,. You could just go to the computer and see how long it took the last time. So you could do it that way. There's a lot of information on there that's a big help. And if you swapped over to another one, all the information would have to be put on.

Stock Controller

What do you use for your job computer wise?

I book all my material in on Redthorn. The material database. It supposedly holds the stock levels.

That's all you use is it Redthorn? You don't use any other computers?

No, just Redthorn.

What do you think of it then? Because you said supposedly right?

Well, I think it's OK. I've had no problems with it at all.

Do you get any information from there or do you just enter stuff in?

I get information off it as well. What, when. What stocks we're holding.

How would you use that then, information you get from it?

Well it would give us a GIN number for the bar that I'm looking for. It would go away and look for the GIN number. See if it's in stocks. It's just handy because if I'm after that bit of bar, that'll tell us if it's in or not, supposedly anyway.

What about entering stuff in? You said you'd enter new stock when it comes in. So you'd enter the GIN number then would you when it comes in?

No, the computer gives us the GIN number when I book the stock in.

Where to put it?

Yes.

What would you do if you didn't have the computer then?

Revert back to the old system where it would all go in a book. It would be hand written into a book.

Is that better or worse than the computer?

It's 6 and 2 3s really basically. The information that was going into my book is going onto the computer now, so.

It's just used instead of the book really?

Yes.

Where do you get the information from that you would enter into the computer?

Off purchase orders which are printed through in the purchase department. And I tie that in with a goods in note that would get off our supplier.

So they print something out for you then?

Yes.

You then enter that into Redthorn?

Yes. Basically, they print the purchase order off the computer.

Off their computer?

Yes.

Not Redthorn?

Yes, Redthorn.

And you enter that into?

I'll enter the order number into the computer, and that'll show me the order on the screen.

And then would you then enter any additional information to that or not?

Well, it'll have quantity ordered, and I'll put the true quantity received.

So, you don't enter anything new then really; it's all there already?

Yes.

You just update it?

Yes.

And then get the information from it where to actually store it?

Yes. I get the GIN number off the computer, and that goes on to the material that comes in, and on to the purchase order, which is filed away.

Would you use anything else on computer? That's it is it?

That's it.

Would you say you used it quite a lot?

Yes.

But doing the same thing?

Well, yes. There are some other bits and pieces I'll do. I'll manually adjust the stocks if I find out say a night shift has taken some bar and I haven't got to know about it. And I've come across it later on in the day, next day. I'll come into the office and I'll manually adjust the stocks.

On the computer then?

Yes. Just to keep the stock balance correct.

And that's about all really?

Yes.

What do you think of it then?

As I say, I've got no problems with it, it helps me a lot.

What about if they were to change it to something else?

I'd probably pick that up. I've moved on from just when we used to use a book. I used to write it all down into a book and moved on onto the computer and I've had no problems.

Purchasing manager

Basically, the girls that work for me, she uses the Redthorn purchasing system. I don't use Redthorn because I find it so cumbersome, time taking and slow. But I can get away without using it. There's a couple of reports that we're supposed to print every day, but we don't because it takes too long. We print it once a week. It was taking 7 hours to print it, so we had to do it on a Saturday. I think we've got it down to about just under 2 hours now. But we still print it on a Saturday.

Which report's that?

Material procurement report. And from that, we count what we're supposed to order. But again, it's once of those things you have to go through, it's item by item, and check that it's actually what we really want and what we're going to use. Like if we're going to use something different, what we have in stock or whatever. But the Redthorn purchasing system all the orders are placed. Well, not all of the orders, but the majority of orders are placed on the Redthorn system. And they just follow through as per the Redthorn book. We do send quite a lot of orders on the old system, Card box, for consummables, things like that.

Is that manual. Is that a computer one?

Well, it is a computer one in a fashion. It's quite a good system really. There's a lot of history there. But we use that system for the consummables and other things that are not going through the Redthorn.

That's on a PC is it?

Yes.

Is that done before Redthorn or after?

That was installed before Redthorn came along.

Was is that system, is that something that you've bought off the shelf or you've just knocked it up yourselves?

It's before my time. I think they bought it off the shelf. I'm sure they did. But like I say, it's before my time.

What is it then, what software is it?

I haven't a clue.

You don't use it yourself then?

Well, the girl that works for me, she uses it, Lianne.

You don't use the computers at all?

I do. I just use Excel.

And what do you use that for?

Everything. Spread sheets, letters, memos, faxes, the lot.

What sort of information would you put in on the spread sheet then?

Well, I do analysis. We use it to formulate enquiries, ten of these, ten of them. Come on in, you can come and have a look if you want.

(In office)

You see what happens is we get this material procurement report.

Right that's from Redthorn is it?

Yes. And it tells us what we want ordering, or what we should be ordering on a certain time. I'll then send an enquiry, like that one I've just done. All this is in the database there, so.

That's in the spreadsheet?

Yes. Just type in the different.

Where've you got the information for that from? Have you typed that in yourself?

In typed all that in.

Where did you get the information for that from?

Well it comes from here.

You got it off the Redthorn thing?

Yes. And these codes come from this database, it tells you the code, what it is, what the spec is.

Is that the other package that you use for consummables ordering then?

No. This comes off the Redthorn. This is the material database. So everything has a code. And then it tells you what it is, and the specification. So I'll look at this. It gives you a bit of information there, but not a lot. It just gives you that bit. I also need that bit, so I have to look it up in here to put it onto the enquires. So that the supplier knows exactly what we want. So that's why I found it cumbersome.

So you get the information off, and then have to go and look it up in two separate places and put it into another package? That's what you found cumbersome.

Yes. Well, the Redthorn system's supposed to allow you to generate an enquiry, which it does but to me it's not clear enough for a supplier to understand what we want. It has to be written out in clear English in my opinion, then you get it right. So, we'll send the enquiry, get the price, and then decide where to send the order, and type it in there. The orders themselves come out like that, which again is something I don't particularly like.

That's the Redthorn?

This is on Redthorn. You see it says, that's a description for the supplier to work from. We send them these drawings or he's already got them. There's a lot of other information on here which is important, and you've got to put it on in the special instructions. Like on this for example, on that one, that one, that one and that one, we're supplying the steel to him. So we write it on there. But sometimes there's so much to write on there, we've got to do a separate sheet because there's isn't enough room. Now these prices will then go into the database. But nowhere does it tell you that those prices were based on free issue steel. So anybody using those, well it could be dangerous because there's a cost of the steel to add. So that's another thing that's not too clever. But the EXCEL spread sheets, I use it for everything. There's one for example. Now this is probably a good example. We've just sent an order for some steel, that's what the computer's generated. It tells the supplier that we want that grade, that classification, and then so many square metres, and that's the price per square metre. The same for that, the same for that. What we actually need is certain sizes of plate, but I can't do it on that. So I have to put on actual plate sizes as per attached sheet. And then we send in that one. What we actually want to achieve that first 8 square metres is one plate at 4 by 2, and that one we want 6 plates at 6 by 3, and so on and so on. Now this spread sheet I can use for all sorts of analysis. The weight I'm talking about, like this delivery's 43 tonnes. Once I've got the price by tonne, all these are formulas to get the total costs and price per square metre, which we need for the order. So that's one of the things that I use EXCEL for.

Where do you get the information for that from. Would that be based on your own knowledge or?

Well, it comes from the Job cards. You see what we're actually told on the job cards, these yellow things is what we require. Now the nearest we can get to that 90.9, is 108 because of the particular plane sizes. The standard sizes in some cases we know some of them we'll be using on other jobs, so we'll order a bit extra. I don't think I see one off the top of my head....There's one. We actually only need just u under 30 square metres, but we're ordering 45 because we know that'll come in useful on other jobs. We just keep it in stock. Another analysis I do is on components there. This describes the component, and then there's two ways we can do it. We can either get the supplier to supply the steel, or we can supply the steel to him. So by getting both prices and putting them into this, and work out at the end of the day which is the best. Buy those and those and those, and these and these and these. And at the end of the day we're saving that much, 13, 14% by doing that.

And all this comes from the job cards initially?

Yes.

To analyse it?

Yes. And then I take it from there, get the prices and everything and do the analysis. I mean there's nothing very clever about it. It's all mundane stuff.

You just wrote them yourself did you? You just set it all up yourself?

Yes. Quite a long list there of fastenings, send that to the supplier, and then he know exactly what you want, puts the prices in and he straight away got the total costs you're talking about. Then, you can start to negotiate once you know the

Would this information be actually be stored in Redthorn and it's just

No, this is my Excel sheets.

But would it be stored there as well and it's just that it's the way it's stored is not adequate for your needs, or is it something that you do additionally to Redthorn.

I do this additionally. From this sheet you see, it tells me like on the fastenings, I need to have of those and those and these and these. But I don't need to order them until next April. And that's October, but we've got plenty in stock to keep us going. March, April, So I wait until we've got a fair bit coming together, then I can send that off to the supplier. But, that's what I use the computer for. Just as a tool to assist me in writing purchases.

What about this other package that the girl who works for you uses, do you think that's better than Redthorn?

The card box?

Yes.

Well, I don't know because Redthorn's so far down the road here now, the system would work without it. I certainly don't like Redthorn. I think these orders are appalling, they're a disgrace to go out the company to be honest. I mean, to me that is an appalling document. What we have to do, we have to cover it with this to say that we're not sending the one by mail unless they want it. But this is the important. "Please note that this is placed in accordance with our standard conditions of purchase, a copy of which is already in your…." That's the important bit. 'Cos there's nothing on there to tell you that. In fact you've got to look hard to find out what this is. There's no means of getting an acknowledgement, there's no acknowledgement tear off slip or anything. So we ask them to send that back to us. So the whole thing might be a good production control system but it's not a very clever professional purchasing system. But then you can't be good at everything can you.

Would the card box be better or not as a purchasing system?

That is a little bit better. That's not bad at all is that.

Would you get any information for this from the card box then?

No, not much. These are the card box orders. Just pick one out. That is a better document. At least it tells you what it is. It tells you what we're asking them to do. And we've got all the conditions and everything else. So that's OK. But this, what we're asking this sub-contractor to do, there's no way that we could get that out the Redthorn system. So we have to send that on Card box, because the Redthorn system wouldn't say that.

Would you enter that information into Redthorn as well, or don't you really need to?

It's probably on the job card as operations. But you can't pull it up to print as a purchase order. So there's those sort of orders where we sub-contract orders for specific things that a supplier's got to do. There's all the consummables, drills , cutting tools, all sorts of things, that go onto Card box because they don't come out of Redthorn, they're just requisitioned from the factory floor.

Oh I see they're out of overheads?

Yes. As well as the, asking what we use Excel for, again it's just analyses really. I like to do this every month if I get the chance. It tells me what the expenditure is on certain categories so that I can immediately see where to concentrate our efforts.

Where would you get the information for that one from?

Well I get that from the accounts department.

Is that from their Pegasus thing or?

Yes.

Then you put it into Excel?

I just put it onto that spreadsheet, and say "please draw a graph". I'm trying to compare it with 96. I started here in 96, we''' get 97 and then next year we'll get 98s, just to see how it's going. Well this is the consummables. Again that shows that they're beginning to get their costs down, but until you have that you got to know where your costs are and then you can start to attack them. What I do on there is very, very basic. Nothing clever at all. I don't know what else I can tell you.

So you basically don't think the information on card box, would that also be on Redthorn as well?

No.

It's just separate?

Um. Occasionally, but not very often.

Would you put any of the card box stuff onto your spread sheets?

Yes. Lianne does quite a lot; I'm getting here to do a lot of analysis. Well, fastenings, drills, inserts, all sorts of these things that are on the card box at the moment. She's busy analysing them now so that we can see what our usages are.

Would you put them into a spread sheet?

Oh, that's what she's doing. And then we can send it out to supplier and say this is what we've used this year. We think we'll use the same next year, give us your best prices.

And would she have to re-type that information in or can you transfer it electronically?

She can transfer it but I don't think it works very well.

So it's retyped?

Yes. It's much easier just to do it again.

TAPE 4 - Paul Brown Jnr

Interviewer (I): Do you know what we're doing?

Employee (E): I don't actually no.

I: Okay. What we're doing is an analysis of the company and the way that we start it is to talk to the directors to get their understanding of how the company operates. The next thing we to is to talk to all of the people that are directly responsible to them. So on the technical side, that's the contract .., the quality manager and the .. and then on the admin side, we've got the administrator, the accountant, the .. . Then we interview all of these people separately to find out exactly what they do. So we've got the director's view of what they think happens, then we've got the next view down of what the people in charge of it think happens, then the next view that we do is the view that cuts all the way across the company, so that we have from an enquiry in to the paid invoice. We want to know exactly what happens. So we've got how we think everything happens, what actually happens, then we find where they don't match. We look for differences in people's perception of what's happening, or we look for bottlenecks or places where there's problems or places that run really smoothly, and then we go to the bottom, and we take the final view, which is the one where we say, why do we do this here, you know, why do you think it is that this bit works so well. You know, because you know, you get that, you get bits which are functionally very efficient and then you get bits that aren't and you want to try and understand the factors that influence it. So that's what we're doing and,

E: I thought this had something to do with the Redthorn system, actually, because we've had a lot of bother with the Redthorn system.

I: Well, we also look at where the IT impacts on your system, so every bit of your job that you do, where there's some IT support, we want to know what it is. Yeah? Now what comes out of it is that I think that possibly what's going to emerge is that the problems with the Redthorn system aren't to do with the system, they're to do with the people that are using it.

E: Yes.

I: You know, it's that the training hasn't been .. So we'll look at what's happens with the system in terms of all of your processes, so we do take a lot of what happens with that. We take three different perspectives of an organisation. We take an organisational perspective, which is .., we take a people perspective and we want to know about how the people interact within the organisation, and we also want to know about the system, and how the people interact with the system and how the system interacts with the organisation. It's quite a complicated picture that we're drawing, but you can see where things don't fit and in being able where things don't fit, you can then identify where efforts need to be directed to try and improve it. Yeah? So, what do you do, what are your main jobs, how do you..

E: I really just coordinate the jobs which come in. What happens is the jobs get faxed through to the administration office.

I: So are they coming in as enquiries at that stage?

E: Yes they are. And once they come in they go to the contracts office, which is also the estimating office. The contracts manager looks through them, and then if he thinks it's necessary they have a starter meeting on these jobs and they're passed to either me or Eddie. Then we do the estimate then either Eddie does the quote himself or he passes it to the administration office to do the quote. It always just passes straight to the girls with me. They do the quotes. We get them back and check the quotes, and then with a standard form we always fill in, the enquiry checklist form, which we fill in.

I: Hang on, quotes checked with enquiry checklist.

E: Then once we do the enquiry checklist, we send the quote off, the file's just filed. And basically that's it until we get the order, if we get the order. And if we get the order, the job cards are then produced on the Redthorn system.

I: Order in, so that goes to contracts and then Redthorn job cards issued.

E: Yes, that's right.

I: So, that's the flow of what happens. That has nothing further to do with you, then, presumably. Right, how do you prepare the estimate?

E: We've got a standard estimate sheet what we fill in. And if there's any material to buy or anything like that, there's another standard sheet we fill in, which we give to the buyer, David Yuhill. And then basically we .. and then that's it.

I: What else

E: On the spreadsheet. That's it.

I: Do you not do the labour?

E: Oh yes, we do the labour as well. Just about all our times the labour. The material cost's totalled up and as I say it's passed through to the administration office.

I: And then that goes into admin.

E: Yes.

I: What else do you do?

E: Not much after that, actually. That's basically about it. There is another, when we do the quotes, we always need two quotes, that's off the administration office, and one of them's filed. Eddie keeps a file. Then we always go back every other week and see which quotes we've got and which we haven't got. And the ones we haven't got we always chase up and see what's happening.

I: Would you, how many times would you go through that process? Do you mark up the files to say why you haven't,

E: We do actually, yes.

I: So you could go through and say, oh well we haven't got that one because they haven't made the decision yet or they were waiting for another tender or whatever.

E: That's right, yes. What we do is usually, if we get the order we put a big tick through it or if we don't get it we put a cross through it and leave a little note at the bottom why we haven't got it.

I: Right, so if you get it, it goes to become an order in, and if you don't get it, it's filed and then it's checked up again until it's dead.

E: Yes.

I: Anything else?

E: No, that's it.

I: Do you deal with the customer?

E: We do yes, either if there's something the matter with the drawing or a problem with the job.

I: Would that be an internal query and that would be an external.

E: Yes

I: Anything else?

E: I can't think of anything else, no.

I: Do you ... quote?

E: Well I do actually, I'm starting again with that now. Peter's passed a lot more my way. Three for the CMC, that I've got, trying to get work. So I was phoning customers.

I: What are you looking for when you dial, are you looking to see if the sort of stuff that you do here is the sort of stuff that they need? Are you looking to identify potential customers, or are you responding to enquiries?

E: Well it's looking for new customers, really, and trying to get more work from existing customers.

I: So are you explaining to existing customers that you can do more than the job that they've got you down for?

E: That's right. I'm also subscribed to a company called Subcontract UK, which have got customers which are looking for certain types of work.

I: Is that fruitful?

E: Well, I suppose so. At first when Peter did the sales he was going to look after this, but he's passed it my way now. So I've got to contact these customers, send them a fax and try to go out and visit them, and the company brochure that we've got, get a new company brochure done. Basically that's it.

I: Sure?

E: Yes, that's it.

I: Where are you supported by IT?

E: What do you mean by that?

I: What systems support your work, so I know a fair amount of the estimating's done with Redthorn, isn't it?

E: Yes.

I: Do you estimate more on repeat jobs or on new work?

E: Well, it depends really. For CNC work, a lot of it's repeat work.

I: Right, so that's going to come off Redthorn, isn't it?

E: Yes.

I: So the job cards, the order in, the contract estimates are supported by Redthorn. Files chased, that's manual, quotes, the quotes are done on a word processor?

E: Yes.

I: When you're preparing the estimates, what do you use? Redthorn or

E: No, it's a standard sheet that we've got.

I: Spreadsheet?

E: No, it's just a standard form that you fill in, you know.

I: Right so are they word-processed?

E: I think so, yes. You can do estimates on the Redthorn, but we haven't actually, Eddie's tried it.

I: So you haven't got it sorted yet?

E: No, we haven't sorted it out yet.

I: Materials required. Does that go, do any of these prices come of it? If it was past work, would it come off it?

E: I suppose, yes.

I: Materials? Or you just pass that to purchasing really, don't you?

E: Yes, they just get that.

I: What about the drawing queries? Would you go back to Redthorn for any of that, job problems?

E: No, the thing is that, it's happened in the past when a customer'll change a drawing, there'll be a drawing changing size, so I change the issue number on that drawing. So I go back into Redthorn and change the issue on the job card. Also, new work that we get in, me or Eddie have to create a new IRN on the computer and do a new job card.

I: What your pay? Do you have a database or anything of pay?

E: All the customers I've contacted, I've got my own record of who I've contacted and that.

I: On the PC?

E: Which is on a PC, yes.

I: Is that .. a database or...

E: Yes

I: Does the CNC have anything to do with word-processing?

E: No, it doesn't.

I: Can you think of anywhere else that's got IT support? Do you hold the quotes in electronic format?

E: No we don't. We do the quotes and they're filed away and if we don't get them, once they become dead, then they're in the filing cabinets for a few years I think, and then they're eventually taken up to be archived.

I: Right. Nothing else to add?

E: No, I think that's it.

I: Right. Thank you very much then.

(End of side A. - Side B blank)

TAPE 5 - Alan Fletcher

Interviewer (I): So this was Peter's view of the things that he has responsibility for, and this is you. Any then that was.. and this is Paul, and these are the .. and that was the.. and then I take all of the contributions and I put it into a mapping tool, so it comes out as all little boxes. So what's your name?

Employee (E): Alan Fletcher.

I: Right. So where do you start?

E: Where do I start? Receipt of an enquiry I suppose. It's logged in a file in a register, the file is reviewed to see if we actually can do it, want to do it, assuming that it will then go,

I: So if you review it, do it, don't do it.

E: So that's basically just a decline. So the estimate is prepared by one of the estimators, which, that could involve requesting quotations through the purchasing department.

I: Would you do that?

E: Yes.

I: Well that's part of, what we really want is,

E: The overview of the department.

I: Yes. What your key responsibilities are, and how they flow.

E: Right, so that happens. That goes to the estimator, they do the estimate, and they quote it.

I: Yes. So you make the decision to do it or not to do it.

E: I'm involved in that decision. The decision might be made because of no capacity in the factory at that time, not really our type of work or too much or whatever. The next important thing is, it's been quoted. An order comes in.

I: Do you get the actual quote?

E: Me personally? There is a file. There are files.

I: So would you have that?

E: Well they're housed in the contracts office.

I: Right, so the estimator would return a quote,

E: Well, the estimator would quote it, a copy of the quote would be obviously in the estimate file, that is filed in the contracts office.

I: Right.

E: So we've quoted it. An order? Right we get an order in. First it's logged and given it's works order number and then I do what's called a contract review, whereby I check the order against what was quoted, to make sure that, em, checking the final quote, checking it complies with our company's quotation. Now that can be two types. One is what you could call a quick review, which is repeat orders.

I: Ah, so is that going to be up here?

E: No. That is the contract review. There are two types of contract reviews. One is for small or repeat orders, whereby I just do it. Everything's all right, everybody knows what's happening.

I: If it fails, it goes back,

E: If it fails I'll discuss it with the client and say, get put right whatever. For example, if he's got a silly delivery date, I'll just phone up and say, look we can't do that. The delivery date will have to be this. The other one is if we get a large contract, whereby we have a contract review meeting, whereby we would discuss the contract with the other managers. And that's managers and the estimator. And there, we go through the order in detail. We look at all the drawings, we check for manufacturing and processing, we make sure there's nothing in there that's going to cause a quality problem. We go through it in detail.

I: That will be materials, quality,

E: Materials, quality,

I: Techniques, processes

E: Yes, well decisions are made whether we're going to subcontract something. That sort of decision could be made, would be made at that meeting. If I go through all the drawings, looking at all the relevant drawings, you tend to see things, then you've got the production people .., and we look at the quality requirements, whether we need third party inspection. You know, we may need to bring in Lloyds or we may have to bring in the customer to inspect it. But this will all be detailed on the purchase order.

I: Right.

E: Okay, it's pass or fail again. If there's any queries we go back, then it's either okay or if there's a problem then I talk to the client and get it sorted out. If it's passed, then the next people that get involved with it are the two estimators. So it goes back to the estimator for planning. By planning I mean labour planning and planning what machines it's going on, what processes are required, basically the job cards are prepared. Labour planning and material planning. Produce the job cards.

When the job card is printed on the Redthorn system, that then links in with purchasing. Purchasing then know they've got things to order.

I: Right so it goes from here,

E: We've got the job card prepared and we've printed it out.

I: And that goes to purchasing.

E: No, the job card goes to the factory. To Stevie, production. A copy goes to purchasing so that production know what they've got to do, purchasing know what they've got to buy, because of the contracts review meeting, inspection know who needs to be called in and when. We know because of the contract review meeting what quality documentation is required, for example if we need a Lloyds certificate, or if we need inspection by the client's representatives, or whatever.

I: So from this, the key people to pick up what they need are quality, purchasing,

E: Is this from the contracts review meeting?

I: Yes. Quality, purchasing and production.

E: So the three managers of those departments are at that meeting, so any possible problems, well lets not say problems, lets say the requirements of the order regarding quality are discussed. We have a look through all the drawings to check if there are any purchases to be made. There may be tools. We look at the jobs and if we haven't got a tool for that, we would buy that. Any possible subcontracts we need to do, well we'll not do that, we'll subcontract that, or we need to subcontract that. Can you source us a client to do that for us? And as far as production is concerned, we'll look and Stevie will say, well I can't get that on a machine lets say, for another three weeks, or that's no good, we'll have to subcontract it. And it's really just to get a very broad view for the way the contract's going to go before we go in to the planning stage. That's why the estimator is at this meeting as well, because the estimator will do the planning. So he'll listen to all of this and he'll say, oh yes, normally we would do that, but we're planning for subcontractors.

I: Okay. Anything else? We've got enquiries and we've got orders.

E: I mean the stuff I do on a day to day basis, I don't progress with clients.

I: No, but you progress jobs.

E: I keep control of jobs, yes. I just call it contract control, really. Now that might be done, if we have a big job and it's going to last a number of months or years, or whatever, most of the big jobs that we've got now do run through years, I'll set up within the contracts office the control document, whether that's computer based or just a file. And in that I try to control when to issue job cards, when equipment is, when the product is required and when it was delivered. I've got a number of spreadsheets,

I: I'll come back to the IT later.

Well as I say, that's either done on a spreadsheet or it's just done manually. Some of these, two, well the only two at the moment, I have to produce monthly contract status reports for the MoD, which I think is, basically I'm keeping control of the contracting, so I know at any date what the situation is on the contract. Try to make sure that we give production enough time to make it for when it's required.

I: Would you take those to a, would you have something like a weekly production meeting?

E: I convene a weekly production meeting, and this is probably the most important meeting that we do. It's normally held on a Tuesday, and at the meeting, we have both estimators, production - Stevie, quality - David, well, the other three managers , the production manager, quality manager and purchasing manager, and both directors. At this meeting we discuss every contract that is going through. So the importance of it is, everyone's aware of, as I say, we know what should be going out that week, we know what things need to be accelerated, we find out what things can be slowed down a little bit to make room for other areas where we need to accelerate production. The week's work is decided, or targeted at that meeting. So we set a weekly target. Also, I produce the minutes of the meeting which are very detailed as far as each particular contract is concerned and any action is put on. And they are copied to everyone .. because it is a very useful document in that it's got all the work in progress, it's got 8 or 9, 10 pages of notes. And that's produced weekly. As I say, a lot of time is spent checking the contracts to make sure that we are in fact where we should be, and the job cards are there for the lads when Stevie says, look I want to start this, I make sure the job cards are there for him, or if not, we can get them for him within a few hours. I see my function as making sure that every contract that we get, no matter how big or how small, goes through the company as efficiently as possible. And the least I can involve these two gentlemen the better. And that's the way I set up contracts. Certainly one contract that we've got, I set it up at a very early stage, and it's a manual document that we do and it's 50 pages and if we didn't have it we would be in deep, because we just couldn't control it. So, it's worth spending time. Certainly with long contracts where they're going on for years, it's worth sitting down for, it doesn't matter how long it takes, and getting it laid down whereby you know that you're recording what's happened when it's happened, and if there's any change, why it's happened. And it need only be a hand-written thing, it will be as big or as small as you want it to be. It doesn't matter what it is, as long as it's there and it's available and it's kept up to date. And it can be a bit laborious filling it out, but the end of the day I know I can put my hand on my heart and look back and say if I hadn't started this, ..

I: So is that available to other people then?

E: Whoever wants to have a look at it.

I: Whoever wants to look at it. So if Stevie needed to look at it and say what's happened on this two and a half years ago, because I'm sure we've seen this hitch before, he can go back and have a look at it.

E: He can see when they wanted it and when they were made. When the card was issued, when the batch was delivered and I've even logged the delivery note which we've got to make.

I: Would you also log materials in on those contracts as well, so that you would have, say you'd subcontracted components, would you have a log of when they came in?

E: Well, subcontracting is a purchase, so that would be handled through purchasing.

I: But where it impacts on the contract, would you not,

E: I would have the certificates of conformity. I mean the one thing that we have got is a contract file for each contract. Now, when the order,

I: Do you maintain those?

E: Yes. So that's the first thing that's done really. When it's logged, it's put in a file and there's certain sections we've set sections out, so everybody knows that section 5 is purely for quality, inspection. So if they've got anything they want to keep, regarding the contract, it may be just a silly bit of paper or a problem, that can go in there, there's a space for them. Certificates of conformity, the actual purchase orders, the documents related to the purchase order, specs, whatever, section 3 is correspondence with the client, section 4 is internal documents, which is contract reviews, order amendments, changes to drawing issues, which is all done through the system. This is all ongoing, if you like. Amendments to orders. Section 5 is inspection, section 6 is delivery documents. That can be our delivery note, in the case of MOD it would be 6-40 certificates, whatever's required. 7 is .. we usually use that for pre-issue items. Pre-issue dose from the client. 8 is subcontract correspondence. That's where I file all the certificates of conformity. When we get an order, when the order comes in, the whole of the estimate file is transferred to section 10 of the contract file. So you've got at the end of the day, when the contract is finished and it's filed, you've got the whole story there from the day of the enquiry, virtually any correspondence to do with that project, it's called a project. I maintain the files, set the files up.

I: Where does the system impact on it?

E: The system?

I: Well, you've got two systems, haven't you? Well, you've got several, you've got Redthorn, you've got Carfox.

E: I don't get involved with Carfox, that's purchasing.

I: Pegasus. So you're involved with Redthorn.

E: I'm involved in Redthorn and my own PC. So Redthorn impacts at planning. When the estimators do the planning, that's all done on estimate prepared. All that's estimate, where's order?

I: Order.

E: Logged, contract review.

I: Check order against file, repeat orders, fail back to file, if passed, goes to contract review.

E: So we're back again, aren't we? After the contract review meeting, when the order is accepted,

I: Oh, I haven't got that on. No, the order's accepted down here. If it passes, it goes to a contract review meeting, if it fails it goes back.

E: So if it's passed to the contract review meeting, then it goes to estimating. Here, you did it here. Passed - estimating.

I: Oh, I took it straight along, didn't I?

E: And that's where it impacts at the planning - labour planning, material planning. And that's the job cards, materials, job cards printed. Goes to production, the job card, and copy goes to, yes, that's right.

I: So you don't log, are these manually logged?

E: I suppose when you do a, the enquiries very rarely get done at all on Redthorn. Odd ones have been done, but generally they are done by hand. When the order is logged, it's just given a works order number at that stage.

I: Is that manual?

E: That's manual, that's just a numerical book that I maintain. Contract review. So the first time that it really hits Redthorn is when we get to the planning.

I: Production meeting. It's going to impact on that isn't it? Do you not pull information off it, to inform the meeting?

E: Normally I just do it off the previous minutes. I maintain the minutes from the previous week, so the minutes of the production meeting I amend by hand as we go along through the week, so I know how many's gone.

I: So you'll have that on your word-processor.

E: Well no, I've just got a hard copy. Phil's got it on the word-processor.

I: Contract files?

E: Contract files, well there just,

I: You don't have to log them into Redthorn or anything like that?

E: No, there's no link with the works order number to Redthorn.

I: Right. Control documentation? Is any of that from Redthorn? No, because you do that.

E: No, because that's all out of here. The only time we,

I: The contract status report?

E: No. The only time that we get involved with Redthorn after that is when the job's finished, and we close it up. Obviously, if amendments come through, I suppose then you could say that, because if an amendment comes through, it really goes through to this stage, and if necessary, it could go.

I: Order in,

E: No, order in or amendment.

I: Or amendment.

E: Yes. It goes through. We may not have a contract review meeting, but I will review the amendment, see what impact it has on the way things are going.

I: Right. So where does your system fit in then? What do you word-process, and what have you got on spreadsheets?

E: Well I just work on spreadsheets. That's all I've got on my PC. The contract status reports, that's on a spreadsheet, and really you could call it whether it's a control documentation, contract control.

I: Is that on a spreadsheet?

E: Yes, it can be part of the same spreadsheet, it might be a separate one.

I: Production meeting?

E: Production meeting is on word processing, which Kirsty does.

I: Right. I'll put it there. You don't have a spreadsheet with orders on or anything like that?

E: No.

I: Database of customers?

E: That's on Redthorn. Every customer has his own identity number.

I: So that's going to be file management, isn't it? Redthorn's going to impact on file management, forwarding customer information.

E: Yes. Really, we should expand on this a bit. Can you just read what that says there?

I: Planning - labour, process, job cards prepared, materials .. into purchasing.

E: In there, really.

I: Do you want to expand, do you want to take this one and do another sheet?

E: Well, when the estimator has finished the planning, sometimes he will enter the order and print the cards out himself, or he'll tell me that's all planned and ready to print out, in which case I then go into Redthorn and enter the order.

I: That's okay, because what we're saying is that the job card is coming out of Redthorn. What ever route it takes to come out of there, this is the thing that generates it.

E: Yes.

I: But there isn't any, estimates, are they word-processed?

E: No, most of the estimates are done by hand. I mean you'll speak to Eddy. Eddy will probably tell you more about the estimating side of things.

I: And you can't see anywhere else, *(end of side 1)*

E: On the contract, a lot of the contracts don't need .. they're just straight up to the factory. But they are, no matter how small, they're all maintained in the same way and they are all discussed at the production meeting. I mean the good thing about the production meeting is that it sets you out each target. You say I want that out, that out, that out, we need transport for that, .. so I think it is the most important meeting in the week because it's the only meeting .. and everybody, all the managers, the inspection personnel, the inspectors, they get a copy of the minutes, so everybody's got information on what the state of that contract is. And it works very well. We do remarkably well as far as deliveries are concerned. And a lot of the big contracts, as I say, it's down to when I first set it up.

I: Yes. It's preparation isn't it? It's like a wallpapering job.

E: Oh yes, I mean any job.

I: Yes. If you prepare properly, then it runs smoothly.

E: A lot of the time is spent with any queries the customer has. You find time. They come to me, and say, what's the situation on that, where is that, and that's where this comes in. Customer queries. Or even the customer just progressing, saying we're due these, can you confirm they're coming in. And obviously some of the customers are not .. but we deal with them .. but it's just trying to keep control, making sure that things are done the way they should be done, like going to the stores and saying this should be in stock. Sometimes it doesn't work, and we've got to rush things through. That's part and parcel of the business. But just to know exactly where you are and that's the way I see it. We get a call and they say has that been invoiced? I can go to the files and I know straight away, and it's,

I: Is that about it?

E: That's about it, as I say, once the job's finished, the delivery documentation is prepared through the inspectors. No doubt David's told you about that - about the certificates of conformity and the advice notes, and they come to me for filing and I prepare whatever needs to be invoiced. So I get the copies of the delivery note. Some go in the file, one copy is the accountant's copy.

I: You'll send that to Brian to invoice, will you?

E: Well, I send it to Kirsty and then Brian checks the figures.

I: Anything else?

E: I can't think.

I: Fine, thank you very much.

I: Say that again. You're the contract manager.

E: As a contracts manager I know Renown pay my wages, and I work for Renown 100%, but I also look on it as I'm the customer's representative here, because if I keep all the customers happy, then everything at Renown should be happy on that particular contract. So, it's keep the customer satisfied, and if that happens then everything's running well. Because if he's happy, it's obvious, it follows, if we're meeting his requirements, we're doing all right ourselves.

I: And they come back.

E: Oh yes.

I: So you know you've got your job for the next 10 years!

E: Hopefully! So that's how I see it. Able to say, what's the situation on whatever contract on whatever day, you should be able to answer it, or find the information, and that, as I say is my function in here. Keep the customer happy.

I: And keep the directors informed.

E: And keep the directors informed, yes. I think that's what they want. They want to be informed. They still want to maintain their control if you like, but in a lot of cases the first Paul sees or Peter sees is the invoice. Now that must make them immensely happy, because they know they never had any problems. If the first Paul gets to know about it is the invoice on his desk for a few thousand pound or whatever, he's a happy man. The same with Peter. Because it means that it's gone through, there's been no problems, it's gone through all the systems, through quality, through purchasing to production, it's followed the route and it's gone out the door, hopefully on time, to specification and within the budget.

I: Right. Thank you very much Alan.

APPENDIX 4

Project gannt chart example

ID	Task Name	Resources / Milestone date
1	Development of workpacks (RAMESES I)	Researcher 1,Researcher 2
2	Develop prototype software tool to support model stages 1 and 2 (RAMESES	Researcher 2
3	Demonstrate tool for Business consultants	Researcher 1
4	Refinement of prototype tool	Researcher 2
5	Trial of prototype tool by researchers at RAMESES 1 SMEs.	Researcher 2,Researcher 1
6	Assess quality of data against case study material	
7	Milestone 1	06/11
8	develop means of data analysis re model stage 3	Researcher 1,Researcher 2
9	Case study analysis at newly collaborating SMEs.	
10	collate data using prototype tool	Researcher 1,Researcher 2
11	gather qualitative data from new SME's	Researcher 1,Researcher 2
12	refine tool to include analitical applications.	Researcher 1,Researcher 2
13	Milestone 2	11/12
14	Develop evaluation mechanism for testing software/model effectiveness	Researcher 1,Researcher 2
15	Develop evaluation mechanism for testing software/model usability	Researcher 1,Researcher 2
16	Test RAMESES I - collaborating consultants (shadowed by researchers)	Researcher 1,ESF M.Phil Student
17	Analysis of consultants' evaluation of model/tool (RAMESES I).	Researcher 1,Researcher 2,ESF M.Phil Student
18	Milestone 3	05/04
19	Case study analysis of collaborating SMEs and selected clients of consultants	Researcher 1,Researcher 2
20	Determine generic and domain specific features	Researcher 1,Researcher 2
21	Milestone 4	14/02
22	Add of Case Based Reasoning element to model (RAMESES II).	Researcher 2,ESF M.Phil Student,Researcher
23	Develop evaluation mechanism for testing effectiveness of RAMESES II	Researcher 1,Researcher 2
24	Develop evaluation mechanism for testing RAMESES II usability	Researcher 1,Researcher 2
25	Test RAMESES II - collaborating consultants (shadowed by researchers)	Researcher 1,ESF M.Phil Student
26	Milestone 5	18/07
27	Analysis of consultants' evaluation and model refinement.	Researcher 1,Researche

ID	Task Name
1	Development of workpacks (RAMESES I) *The workpacks are now close to completion with the development of WP 1.BP this workpack will consist of a list of components which the organisations will use to assemble their own process descriptions.* *The detailed version of the WP 1.ORG should be near completion following a meeting on 1/10/98* *The additional information is now supplied the workpacks are therefore complete. Subject to review.*
2	Develop prototype software tool to support model stages 1 and 2 (RAMESES I). *The tool is near completion ready and at the review stage. Completion will depend upon the final development of the workpacks. At this stage whilst thought is being given to the analytical element of the tool, it will incorporated only once we had had a chance to work with the data and collect information about suitable methods from a wider audience throughout the school.* *The tool is ready bar the addition of the workpacks to complete WP 1. ORG this pack is now complete bar coding. Aim for complete tool for RAMESES meeting 15/10/98. The tool will then be subject to review in the next task*
3	Demonstrate tool for Business consultants *Arrange date with Norman at RAMESES meeting 15/10/98*
4	Refinement of prototype tool *The tool will be worked through by the team to begin the refinement process*
5	Trial of prototype tool by researchers at RAMESES 1 SMEs.
6	Assess quality of data against case study material
7	Milestone 1 *This task will consist of a key report of:-* *a) description of tool* *b) report on reasons for refinements etc* *c) describe field studies* *d) compare and contrast data* *e) relate above information to workplan*
8	develop means of data analysis re model stage 3 *This task will sit in the background of this phase of the project and subsequent tasks will need to be aware of the data analysis needed for stage three of the model.* *This task was identified as requiring attention at the RAMES meeting of the 1/10/98 we outlined the need to map the solution space in order to develop the means of data analysis. The body of this task is expected to be undertaken by Caroline ..the new postgrad student.*
10	collate data using prototype tool
11	gather qualitative data from new SME's
12	refine tool to include analitical applications.
13	Milestone 2 *This task will assess the progress from previous milestone as follows:-* *a) describe analytical methods?* *b) write case study report* *of, 1 tool gathered data* *2 qualativley gathered data* *c) compare and contrast results* *d) describe tool refinements as a result of work done* *e) do work plan for next milestone*
14	Develop evaluation mechanism for testing software/model effectiveness
15	Develop evaluation mechanism for testing software/model usability
16	Test RAMESES I - collaborating consultants (shadowed by researchers)

APPENDIX 5

User satisfaction questionaire

SYSTEM ASSESSMENT QUESTIONNAIRE

This questionnaire should take a maximum of 20 minutes to complete
All participants are ensured complete confidentiality
You may choose more than one answer where applicable

SECTION 1: ABOUT THE SYSTEM

1. For what purpose do you use the system?

- [ ] **Completing Transactions**
- [ ] **Supporting Decision Making Activities**
- [ ] **Reviewing Past Performances and Raising Questions**
- [ ] **All three of the above**
- [ ] **None of the above, if so, please describe why you use the system**

....
....
....

2. Approximately how long do you have to wait for information to be retrieved by the system (if applicable)

- [ ] **The information is available immediately**
- [ ] **The information is available with 30 minutes**
- [ ] **The information is available between 30 minutes to one hour**
- [ ] **The information takes more than one hour to be retrieved by the system**

3. Does the system have any documentation? For example, manuals, instructions etc?

- [ ] **Yes**
- [ ] **No**

4. If so, how would you describe the quality of the system documentation?

- [ ] **Excellent**
- [ ] **Very Good**
- [ ] **Good**
- [ ] **Fair**
- [ ] **Poor with some helpful areas**
- [ ] **Poor**

SECTION 2: YOUR OPINIONS ON THE SYSTEM

5. In your opinion does the system allow you to increase the level of productivity with regard to your own work?

- [ ] It helps a great deal to increase my own personal productivity levels
- [ ] It helps in many parts to increase my own personal productivity levels
- [ ] It is satisfactory in increasing my own personal level of productivity
- [ ] It helps in some parts to increase my own personal productivity levels
- [ ] Not at all - It does not help increase my own levels of productivity

6. Since the system has changed to what extent does it assist you in improving your job performance?

- [ ] It helps a great deal
- [ ] It helps in many parts
- [ ] It is satisfactory
- [ ] It helps in some parts
- [ ] It helps a little
- [ ] Not at all

7. In general, how would you describe the ease of use of the system?

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Fair
- [ ] Poor in areas
- [ ] Poor

8. How would you describe the system interfaces? (Interfaces refer to the display screens of the system, are they simple to understand and work through etc?

- [ ] Excellent
- [ ] Good
- [ ] Generally Good
- [ ] Average
- [ ] Below Average
- [ ] Poor

9. Does the system provide the accurate and precise information you need?

- [ ] Always
- [ ] Almost Always
- [ ] Often
- [ ] Occasionally
- [ ] Very Occasionally
- [ ] Never

10. To what extent are the outputs of the system e.g reports etc. actually used?

- [ ] Always
- [ ] Almost Always
- [ ] Often
- [ ] Occasionally
- [ ] Very Occasionally
- [ ] Never

11. Does the system motivate you to complete your tasks?

- [ ] A Great Deal
- [ ] In Many Parts
- [ ] It is satisfactory
- [ ] In Some Parts
- [ ] A Little
- [ ] Not at all

12. Does it help you to achieve your personal goals?

- [ ] Always
- [ ] Almost Always
- [ ] Often
- [ ] Occasionally
- [ ] Very Occasionally
- [ ] Never

13. To what extent do you actually use this system compared to your original expectations?

- [ ] Much More than anticipated
- [ ] More than anticipated
- [ ] A little more than anticipated
- [ ] System use matches my anticipated expectations
- [ ] Less than anticipated
- [ ] Much Less than anticipated

14. Does the system allow you to make decisions more effectively?

- [ ] Yes
- [ ] No
- [ ] Don't Know
- [ ] Not Applicable

15. To what extent have you experienced difficulty in operating the system?

- [ ] Always
- [ ] Almost Always
- [ ] Often
- [ ] Occasionally
- [ ] Very Occasionally
- [ ] Never

16. In your opinion, is the system limited in any way? If so, how
....
....
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17. Would you prefer additional training in certain aspects of using the system?

- [ ] Yes, if so, which aspects are these?..............................
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- [ ] No, additional training/training is not needed

SECTION 3: THE ORGANISATIONAL ASPECTS OF THE SYSTEM

18. How would you describe the level of support from IT staff within your organisation?

- [ ] Excellent
- [ ] Very Good
- [ ] Good
- [ ] Fair
- [ ] Poor in Areas
- [ ] Poor

20. **Are there any additional comments you would like to make?**

21. **Please prioritise any needs not currently available from the system?**

22. **Do you submit data to the system for which you see no purpose?**

Thank-You for taking the time to complete this questionnaire